A Dissertation on

A STUDY ON PERITONEAL FLUID CULTURE AND ITS ANTIBIOTIC SENSITIVITY IN PERFORATIVE PERITONITIS PATIENTS IN CMCH COIMBATORE MEDICAL COLLEGE HOSPITAL

Dissertation submitted to

THE TAMIL NADU DR.M.G.R. MEDICAL UNIVERSITY

CHENNAI - 32, TAMIL NADU

With partial fulfilment of the regulations
For the award of the degree of

M.S. DEGREE EXAMINATION

BRANCH I – GENERAL SURGERY

COIMBATORE MEDICAL COLLEGE HOSPITAL

COIMBATORE

APRIL 2016

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation titled "**A STUDY ON PERITONEAL FLUID CULTURE AND ITS ANTIBIOTIC SENSITIVITY IN PERFORATIVE PERITONITIS PATIENTS IN CMCH"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. D. N. RENGANATHAN, M.S, FAIS., Professor, Department of GENERAL SURGERY, Coimbatore Medical College and Hospital,** Tamil Nadu, India.

DATE: Signature of the Candidate

PLACE: COIMBATORE **Dr. P. A. ABINAYAVALLABAN**

CERTIFICATE

This is to certify that dissertation entitled, "A STUDY ON PERITONEAL FLUID CULTURE AND ITS ANTIBIOTIC SENSITIVITY IN PERFORATIVE PERITONITIS PATIENTS IN CMCH" Submitted by Dr. P. A. ABINAYAVALLABAN in partial fulfilment for the award of the degree of master of surgery in GENERAL SURGERY by The Tamil Nadu Dr. M.G.R. Medical University, Chennai, is a bonafide record of the work done by him in the Department of general surgery, Coimbatore Medical College and Hospital Coimbatore, during the academic year 2013-2016.

Guide & Professor

Department of General surgery

Professor & HOD

Department of General surgery

Dean

Coimbatore Medical College & Hospital

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ETHICS COMMITTEE

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Course : MS General Surgery

Period of Study : 2013 - 2016

College : Coimbatore Medical College

Dissertation Topic : A study on peritoneal fluid culture & its antibiotic sensitivity in Perforative peritonitic cases in CMCH.

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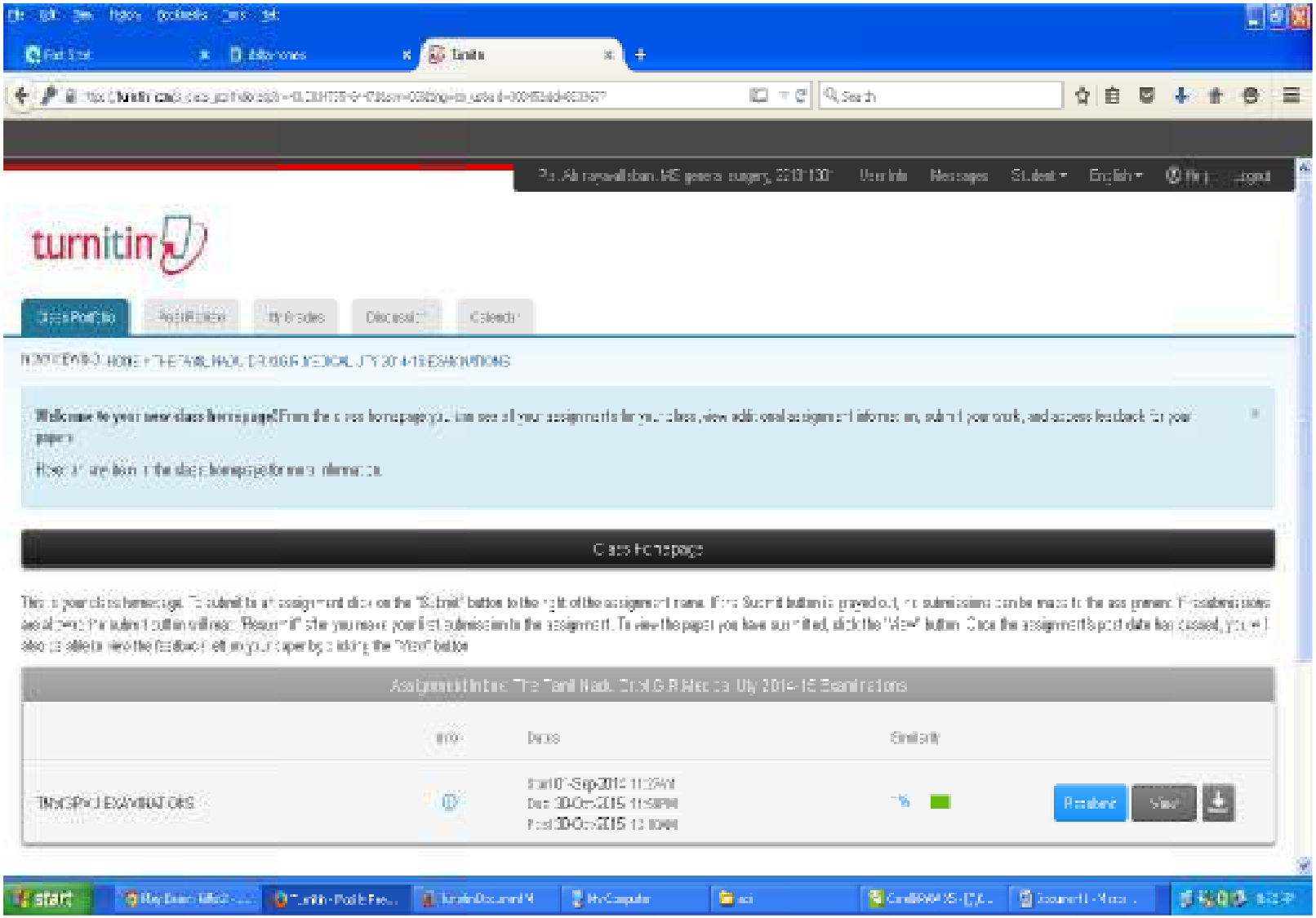
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ABSTRACT

A STUDY ON PERITONEAL FLUID CULTURE AND ITS ANTIBIOTIC SENSITIVITY IN PERFORATIVE PERITONITIS PATIENTS IN CMCH

BACKGROUND

Peritonitis remains one of the most common problems faced by a General surgeon. Only in recent decades there has been significant improvement in treatment of peritonitis both by use of antibiotic and surgery. The surgeons treating it know the dreadful and fatal complication, the problems can be minor wound infection to dangerous septic shock or SIRS (systemic inflammatory response syndrome). The treatment can be done easily by starting a certain line of antibiotic therapy these usually include a broad spectrum antibiotic that covers gram positive, gram negative and anaerobes. However the problem now is the development of resistance to these antibiotics and results in high failure rates in the treatment.

AIMS AND OBJECTIVES

1. To study bacteriological pattern in peritoneal fluid by culture.
2. To determine antibiotic sensitivity and resistance pattern for commonly used antibiotics to the organisms grown in culture.

MATERIALS

DESIGN OF STUDY: Cross sectional study

PLACE OF STUDY: Coimbatore Medical College and Hospital

STUDY PERIOD: AUGUST 2014-JULY 2015

STUDY POPULATION: Patients presenting to Coimbatore medical college hospital with perforation peritonitis.

SAMPLE SIZE: 50

INCLUSION CRITERIA:

1. Patient presenting with features of perforation peritonitis and confirmed by x ray
2. Age more than 18 yrs

EXCLUSION CRITERIA:

1. Patient presenting with primary peritonitis
2. Peritonitis due to trauma

METHODOLOGY

PRE OPERATIVE EVALUATION

Patients with features of perforation peritonitis presenting to casualty to Coimbatore medical college were admitted. Following which detailed history were taken and complete physical examination were done and diagnosis is confirmed using chest and abdomen X ray erect which shows air under diaphragm. Following which routine investigations like CBC, Blood urea and sugar and serum creatinine and electrolytes and ECG were done.

PREOPERATIVE PREPARATION

Patient confirmed with diagnosis of perforation peritonitis were resuscitated with intravenous fluid and stabilising the patient vitals were planned for emergency laparotomy and taken up for surgery after getting consent from the patient and his/ her attenders.

INTRAOPERATIVE PROCEDURE

Emergency laparotomy done using midline incision and peritoneal fluid was obtained from confirmed non traumatic cases and sent for aerobic microbiological culture. Following which perforation closure is done using vicryl with live omental patch and abdomen is closed after keeping abdominal drains.

POST OPERATIVE CARE

Following surgery patient were given routine postoperative care with intravenous fluids and antibiotics. Peritoneal fluid culture reports were followed up and the isolated organisms were tested for antimicrobial sensitivity by Kirby-Bauer disc diffusion method using ampicillin, amikacin, ciprofloxacin, ceftriaxone and cotrimoxazole and the culture reports were obtained. Antibiotics were changed according to the sensitivity pattern of organism grown in the culture.

LIMITATION OF THE STUDY

1. Study population is small
2. Shorter duration of study

OBSERVATION AND RESULTS

AGE DISTRIBUTION

Age	Number
20 to 30 yrs	13
31 to 40 yrs	18
41 to 50 yrs	10
>50 yrs	9

This study shows that the most common age group of presentation is about 31 to 40 yrs (36%) followed by 20 to 30 yrs (26%). The mean age of presentation is being 35.26 yrs.

SEX DISTRIBUTION

Sex	Number
Male	44
Female	6

The sex distribution in this study shows perforation being more common in male (88%) than female (12%). This finding is comparable to most of the related studies.

DISCUSSION

Secondary peritonitis caused by hollow viscus perforation is common. It has high mortality rate due to late presentation of patient to hospital. In our study most of the cases of perforation were seen in the age group of 31-40yrs followed by 20 – 30 yrs. The mean age of presentation is 35.26 yrs of age. From our study, it has been noticed that the most common site of perforation is in 2nd part of duodenum 52% followed by gastric in 42% of cases. The most common organism grown were Klebsiella 46% followed by E coli in 34% of cases only 2% showed mixed growth of both E coli and Klebsiella. In our study, the sensitivity patterns of cultured organisms were analysed. It showed that organisms were sensitive in most cases to ceftriaxone followed by ciprofloxacin and amikacin.

CONCLUSION

In this study, it is concluded that perforation most commonly seen in duodenum followed by stomach. Most of the cases were due to peptic ulcer disease. Secondary peritonitis caused in these cases was most commonly due to Klebsiella followed by Escherichia coli and rarely by mixed, proteus and pseudomonas. Both Klebsiella and Escherichia coli were sensitive to cephalosporin group of drugs followed by quinolones and then macrolide antibiotics.

KEY WORDS

Peritonitis, peritoneal fluid culture, antibiotic sensitivity

INTRODUCTION

Peritonitis remains one of the most common problems faced by a General surgeon. Whether it is a simple duodenal perforation, traumatic perforation, appendicular perforation, or a case of acute pancreatitis complicated by a pancreatic abscess, it still remains as a major cause of morbidity and mortality. Only in recent decades there has been significant improvement in treatment of peritonitis both by use of antibiotic and surgery.

Intra abdominal infection is a major challenge to the surgeon. Peritonitis which we commonly come to us is secondary peritonitis occurring due to perforation of hollow viscus. The surgeons treating it know the dreadful and fatal complication, the problems can be minor wound infection to dangerous septic shock or SIRS (systemic inflammatory response syndrome).

There are various obstacles for treatment of peritonitis they include

- The age of patient
- Time interval of presentation
- General condition and nutritional status of patient
- Presence of any malignancy
- Post operative complications

The other fact which makes peritonitis more dangerous is due the very high amount of contamination of the peritoneal cavity by certain fatal organisms belonging to the enterobacteriaceae family . These include E.coli , klebsiellla, proteus, enterococci species . These organisms directly or by their toxins cause certain effects which leads to the onset of SIRS . Alteimer in the 1930 s isolated polymicrobial organisms from the peritoneal fluid and also showed that their pathogenicity is causing intra abdominal sepsis

The antibiotic treatment of intra abdominal infection has evolved for the period of past 30 years and is based on solid experimental and class 1 clinical data. In fact the earliest experiment done by Weinstein et al showed that a combined therapy targeted towards both aerobic and anaerobic organisms was regarded as correct regarding survival and helped minimizing abscess formation.

Current therapy towards the treatment of peritonitis is directed at correction of underlying cause, administration of systemic antibiotics to control infection and facilitating supportive therapy to prevent formation of SIRS.

With antibiotic administration it was found that if the therapy was directed towards aerobes there was lesser mortality and more residual abscess formation but when therapy was directed towards anaerobes there

was less abscess formation and mortality remained unchanged. Therefore therapy was considered optimal when combination was used.

The treatment can be done easily by starting a certain line of antibiotic therapy these usually include a broad spectrum antibiotic that covers gram positive, gram negative and anaerobes. However the problem now is the development of resistance to these antibiotics and results in high failure rates in the treatment.

In this study, various organisms that are growing in the peritoneal fluid culture of the patients presenting with perforative peritonitis and their antibiotic sensitivity and resistance pattern in our institute were analysed, So that we can initiate early and appropriate antibiotic therapy in our patients presenting with perforative peritonitis preoperatively which can improve the outcome of the patient.

AIM

To analyse bacteriological and its sensitivity pattern in peritoneal fluid in cases of perforative peritonitis admitted in CMCH from August 2014- July 2015, so as to select appropriate empirical antibiotic therapy.

OBJECTIVES

1. To study bacteriological pattern in peritoneal fluid by culture.

2. To determine antibiotic sensitivity and resistance pattern for commonly used antibiotics to the organisms grown in culture.

REVIEW OF LITERATURE

PROBLEM STATEMENT:

Perforation peritonitis is one of the commonest surgical emergency we come across in our practice. Though there are many recent advances in the field of medicine, perforation peritonitis still has a major threat to the surgeon. The major problem faced by the surgeons is the late presentation of patient to the doctor and development of resistance bacterial organisms that causes peritonitis and sepsis. With increasing risk of emerging drug resistance to antibiotics, this problem has to be taken care of in rapid manner.

DEFINITION:

Peritonitis is inflammation of the peritoneal covering the abdominal cavity. The aetiology of peritonitis may vary but the outcome of it remains same in all cases.

Peritonitis is also used interchangeably with intrabdominal sepsis. The most common peritonitis we come across in surgical practice is perforation peritonitis either infective or traumatic etiology or postoperative following anastomotic leak.

Peritonitis is of three types, 1. Primary 2. Secondary 3. Tertiary.

Primary peritonitis is defined as bacterial infection of peritoneal cavity that occurs arising from extraperitoneal site possibly lymphatic or hematogenous spread. It occurs most commonly in alcoholic cirrhosis with ascites and in nephritic syndrome. Presence of ascites increases the chance of developing peritonitis due to low protein concentration.

Secondary peritonitis occurs as a result of contamination from intraperitoneal organ within peritoneal cavity. Most of the cases occurs as result of primary lesion in duodenum, stomach and appendix. 10% cases of secondary peritonitis occurs as a complication of abdominal surgery.

Tertiary peritonitis refers to persistent diffuse peritonitis that occurs after initial treatment for secondary peritonitis. It appears to represent both failure of host response and superinfection.

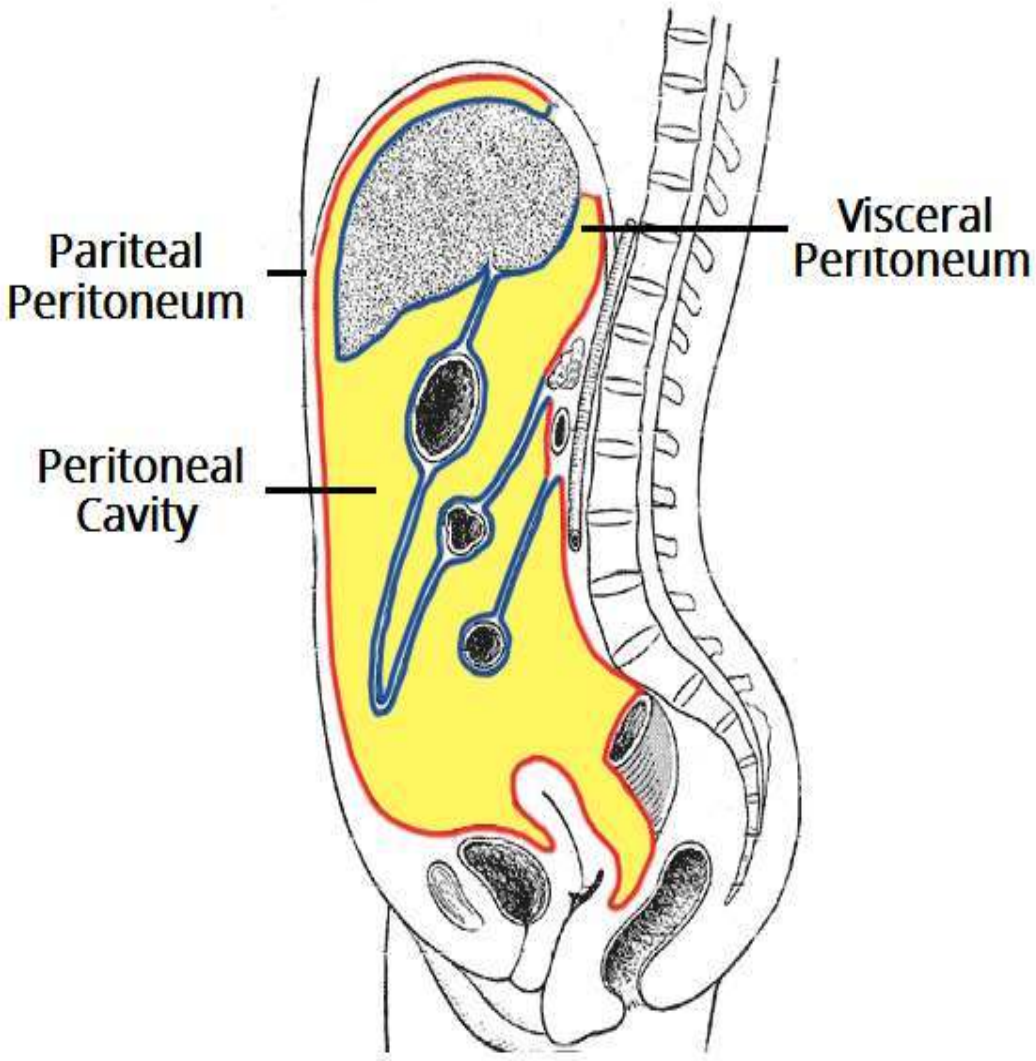
ANATOMY AND PHYSIOLOGY :

PERITONEUM:

The peritoneum is a serous membrane. It is single layered and arranged over condensed areolar tissue. It is made up of mesothelial cells. It roughly has surface area of 1.2 to 1.5 m^2.

It secretes serous fluid which helps in lubrication of the internal visceral organs.

PICTORIAL REPRESENTATION OF PERITONEAL CAVITY



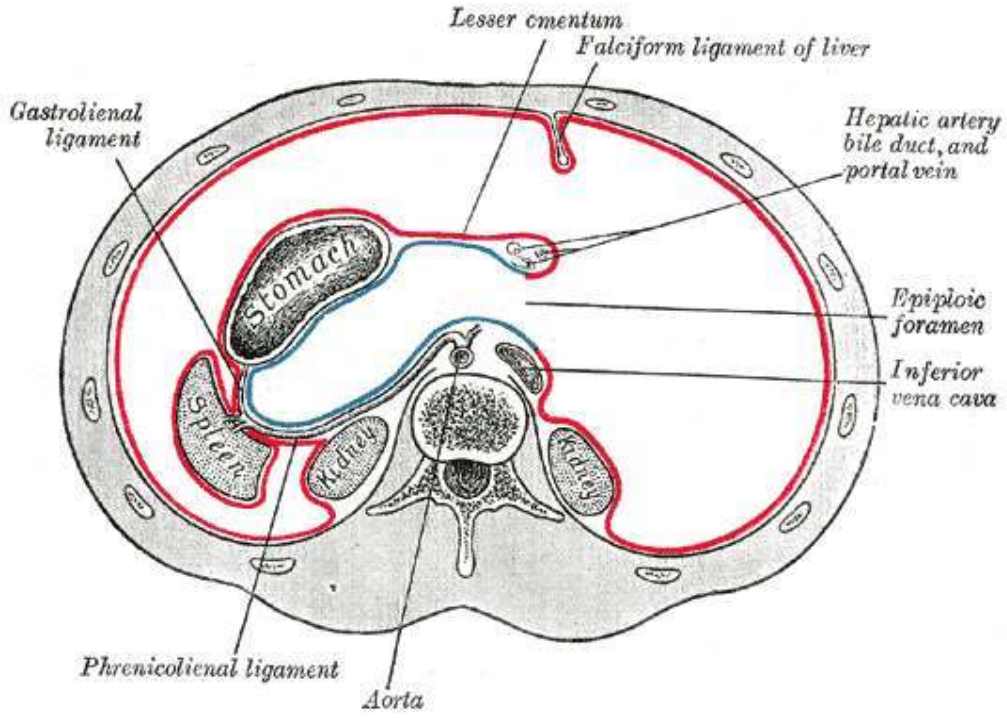
It has two divisions namely

1. Parietal peritoneum and
2. Visceral peritoneum

Parietal peritoneum	Visceral peritoneum
Develops from somatopleuric mesoderm	Develops from splanchnopleuric mesoderm
Lines inner aspect of abdomen and pelvis	Adherent to visceral organs
Receives its blood supply from adjacent parietal wall	Receives its blood supply from viscera to which it is adherent
Pain sensitive	Pain insensitive

The two peritoneum are continuous with one another through peritoneal folds. They are of 3 types

1. Ligament
2. Omentum
3. Mesentry



PERITONEAL LIGAMENTS AND ITS ATTACHMENTS

Ligaments are found between two viscera (Ex: Linorenal ligament)

or viscera to parietal wall (Ex: falciform ligament).

Omenta are found between stomach and other organs. Ex: lesser and greater omentum.

Mesentry is found between intestine and posterior abdominal wall. Ex: small bowel mesentry.

PERITONEAL CAVITY:

Between two layers of peritoneum, there lies a potential space called peritoneal cavity.

Peritoneal cavity has minimal amount of serous fluid. Its main function is to lubricate the visceral organs inside the abdominal cavity.

It also consists of neutrophils which aids in scavenging the organisms during infection.

It is a closed cavity in case of males and open in case of females.

The visceral organs found inside the abdominal cavity can be divided into two as intraperitoneal or extra peritoneal depending upon location of viscera, either inside or outside peritoneal cavity.

The peritoneal cavity is divided by liver and peritoneal folds above the line of attachment of transverse mesocolon into supra hepatic and infrahepatic spaces.

The importance of it is being formation of abscess in this region following perforation due to ulcer and perforation due to amoebic abscess. The reason behind the cause for formation of abscess is flow of peritoneal fluid for drainage in the sub diaphragmatic space.

FUNCTIONS OF PERITONEUM:

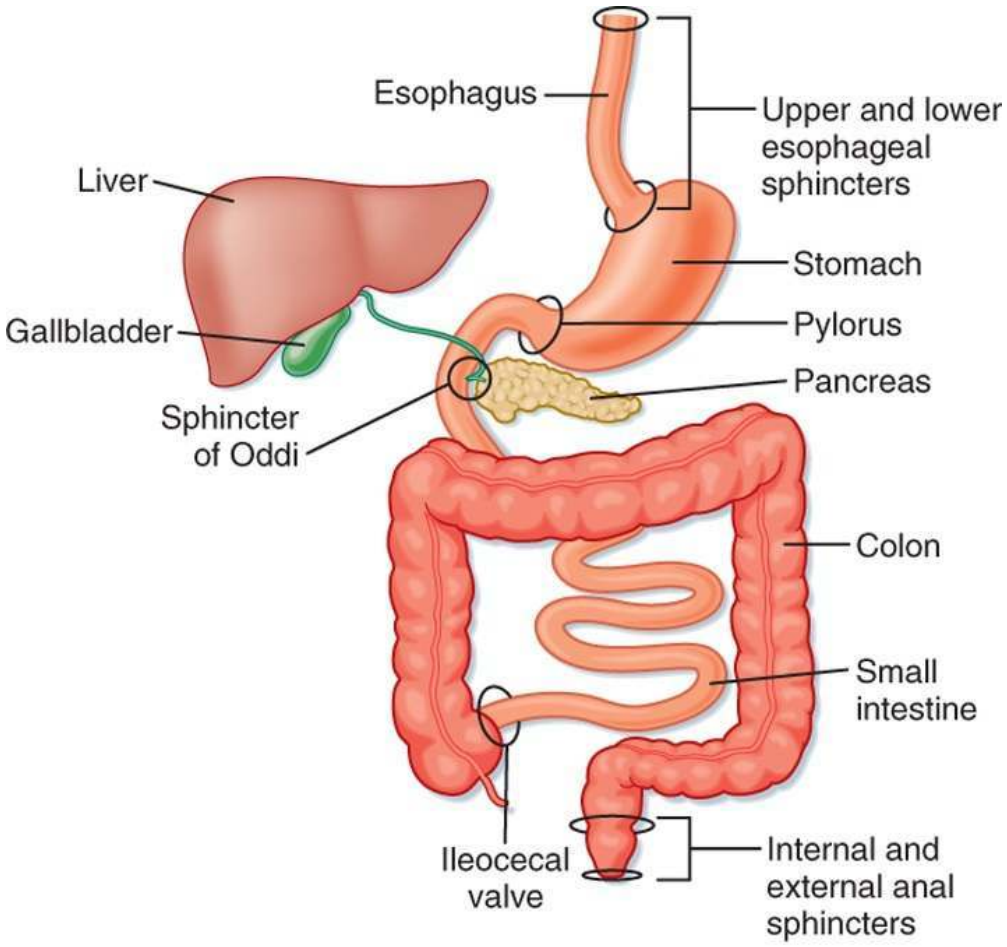
1. Through various folds of peritoneum, the blood vessels and lymphatics supply the visceral organ.
2. Stores fat in omentum.
3. Peritoneum secretes peritoneal fluid rich in neutrophils which help in scavenging.
4. Helps in lubrication of organs.
5. The greater omentum present in the peritoneum has constant movement and it adheres with areas of inflammation, thereby restricting the inflammation.

STOMACH:

The stomach is an organ of storage and mixes the swallowed food for further digestion. The chyme which is prepared is sent to small intestine for absorption.

Stomach has a pH of 1.5 to 2.0. It is the place where most acidic pH is present in the body.

Due to this property most of the bacteria are getting killed in the stomach, which makes only acid resistant bacteria to grow like H. Pylori.



SMALL INTESTINE :

The small intestine makes the largest portion of the gastrointestinal tract. It measures about 280 cms approximately. The small intestine extends from duodenum to ileum.

It has major absorptive surface and most of the absorption takes place within the small intestine. The small intestine plays a major role in enterohepatic circulation.

LARGE INTESTINE :

The colon and rectum constitute a tube of variable diameter about 150 cm in length. The terminal ileum empties into the cecum through a thickened, nipple-shaped invagination, the ileocecal valve.

The cecum is a capacious sac-like segment of the proximal colon with an average diameter of 7.5 cm and length of 10 cm.

The appendix extends from the cecum about 3 cm below the ileocecal valve as a blind-ending elongated tube 8 to 10 cm in length.

The ascending colon, about 15 cm in length, runs upward toward the liver on the right side. the posterior surface is fixed against the retroperitoneum, whereas the lateral and anterior surfaces are true intraperitoneal structures. The *white line of Toldt* represents the fusion of the mesentery with the posterior peritoneum.

The transverse colon has a length of 40 to 45 cms. It has two fixed points one at hepatic flexure and other at spleenic flexure. On the superior aspect of the transverse colon, it has attachment of greater omentum. The greater omentum is also called as the police man of the abdomen and aids in localising the infection.

The descending colon lies ventral to the left kidney and extends downward from the spleenic flexure for about 25 cm.

The sigmoid colon varies in length from 15 to 50 cm (average, 38 cm) and is very mobile. The mesosigmoid is frequently attached to the left pelvic sidewall, producing a small recess in the mesentery known as the *intersigmoid fossa*.

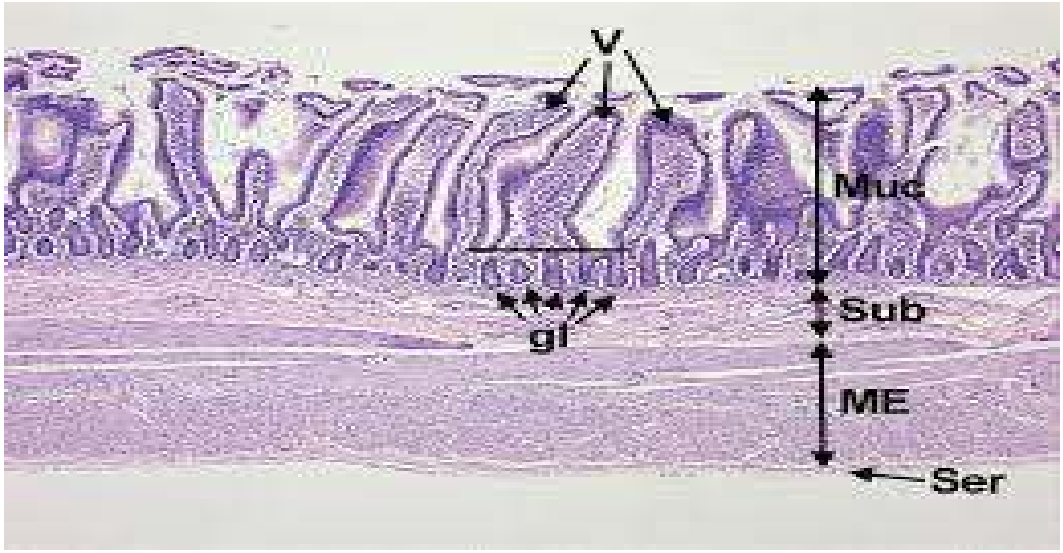
The rectum measures about 15 cm. It lacks taeniae coli or appendices epiploicae. It occupies the curve of the sacrum. The posterior surface of the rectum is outside the peritoneal cavity. Whereas only the upper third of anterior rectum is covered by peritoneum. This space between rectum and uterus is called the *Douglas* pouch or the *pelvic cul-de-sac* and may serve as the site of so-called drop metastases from visceral tumors. These peritoneal metastases can form a mass in the cul-de-sac (called *Bloomer's shelf*) that can be detected by a digital rectal examination.

Microscopically bowel wall is made up of following layers. They are

1. serosa
2. muscularis propria,
3. submucosa, and
4. mucosa

serosa is the outer most layer among all four layers. It is made up of single layer of epithelium.

HISTOLOGY OF INTESTINE



The **muscularis propria** is the second layer from outwards next to serosa. It is made up of two layers inner circular and outer longitudinal layer. Between the two muscular layer there lies the myentric plexuses.

The ***submucosa*** is a made up of fibroelastic connective tissue. It contains blood vessels and nerves. It is the strongest component of the intestinal wall. Meissner plexus is present in this layer. extensive plexus of nerve fibers and ganglion cells (Meissner plexus).

The ***mucosa*** is the inner most of all four layer. It is made of

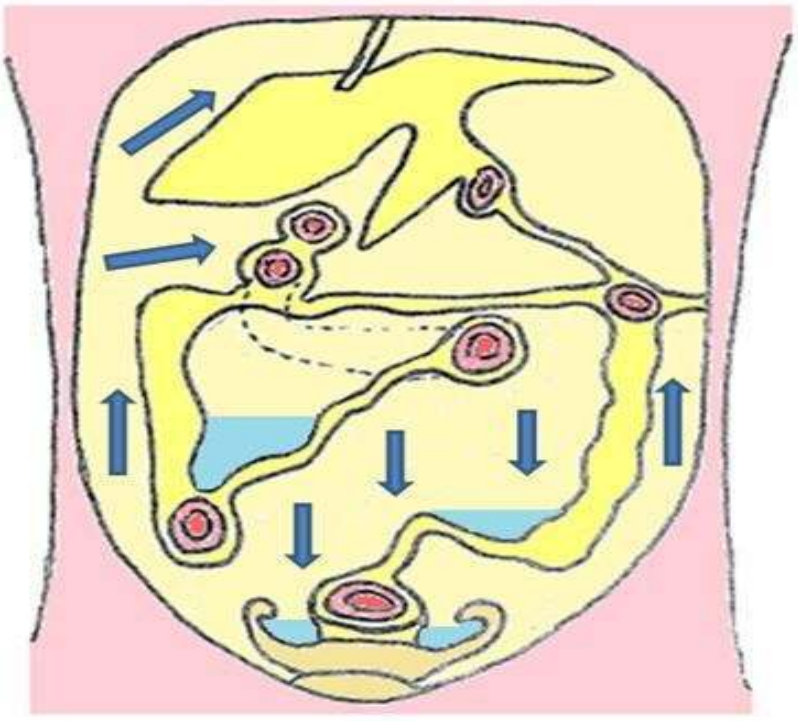
1. muscularis mucosae,
2. lamina propria, and
3. epithelial layer:

PHYSIOLOGY:

The peritoneum is made of single layer of mesothelial cells. It acts like a semi permeable membrane. The peritoneum since it is made up of single layer of cells it allows movement of solutes across the membrane. This property has been made used in cases of peritoneal dialysis in renal failure patients.

The peritoneum is also consists of peritoneal fluid. Peritoneal fluid is present in minimal quantities of about 100 ml. It helps in lubrication and also helps in scavenging and phagocytosis of bacteria.

FLOW OF PERITONEAL FLUID INSIDE THE PERITONEAL CAVITY



The mesothelium of peritoneum has micro villi; it helps in increased absorption of fluid from peritoneum to systemic circulation.

Normally the peritoneal fluid is pumped and directed towards the sub diaphragmatic area due to diaphragmatic pump mechanism. During exhalation the sub diaphragmatic lymphatics opens up causing the peritoneal fluid to enter mediastinal lymphatics. And during inhalation lymph from mediastinal duct reaches the thoracic duct.

By this way the intraabdominal infection rapidly reaches the systemic circulation and causes sepsis.

PERITONITIS

It is the inflammation of peritoneal covering. It can be caused by bacteria, virus, fungi or chemical irritants. Though peritonitis caused by different etiological factors, the sequence of events occurs remains the same.

Peritonitis divided into three types based on nature of microbilogical contamination

1. Primary (without bowel perforation)
2. Secondary (following bowel perforation)
3. Tertiary

CAUSES

The common causes are

Peptic ulcer perforation

Tuberculosis

Crohn's disease

Ulcerative colitis

Diverticulitis

Malignancy

Trauma

Iatrogenic

LOCAL RESPONSE TO PERITONEAL INFECTION

The main aim of local response of peritoneum to infection is removal or containment of micro organisms. Bacterial endotoxins , capsular polysaccharides and non infective irritants act as stimulant for inflammation.

The peritoneal inflammatory process consists of

1. Alteration in blood flow and permeability
2. Bacterial phagocytosis

3. Fibrin deposition and abscess formation

Alteration of blood flow and vascular permeability

It is the earliest change that occurs following peritonitis. Histamine and bradykinin are the common mediators of inflammation which causes pain, vasodilatation and increased permeability of blood vessels.

This results in alteration of peritoneal flow which is initially bidirectional later due to infection resulting in unidirectional flow, causing transudation of fluid to peritoneum. With increased permeability transudate followed by exudation of enormous amounts of immunoglobulins, complements and coagulation factors to the foci of infection resulting in third space fluid loss.

BACTERIAL PHAGOCYTOSIS

Due to changes in blood flow in peritonitis and activation of which within 4 to 6 hrs of injury resulting in chemotaxis and phagocytosis of bacteria towards the site of insult.

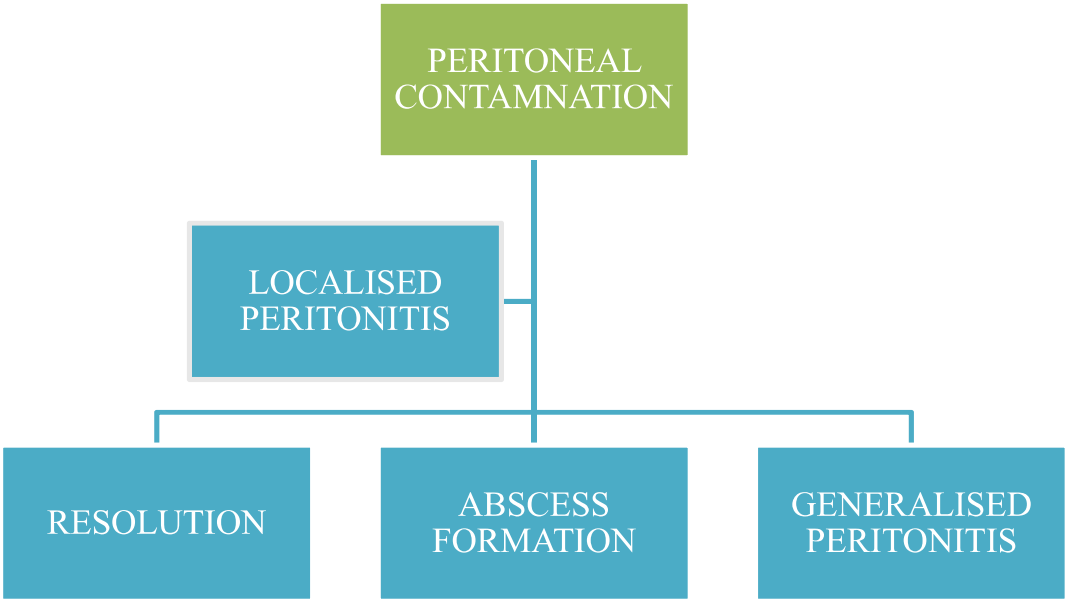
FIBRIN DEPOSITION AND ABSCESS FORMATION

It plays a major role in local inflammation. Main aim of fibrin deposition is to contain and isolate contamination, which prevents widespread contamination. Sometimes fibrin deposition in enormous can

cause adherence of loops of intestine to one another or with the parietal peritoneum.

Fibrin deposition also covers the bacteria in the area of infection thereby preventing the action of neutrophils on microbes resulting in the formation of abscess.

OUTCOMES OF SURGICAL PERITONITIS



PERITONEAL HEALING

Following peritoneal injury, the mesothelium begins to cover the wound tissue within three days of injury. By 5th day of insult the healing process of mesothelium is complete and resembles the normal cells.

The possibilities by which the mesothelium is formed are 1. Differentiation of stem cell from submesothelially, 2. By differentiation of monocyte and macrophage in peritoneal fluid.

FACTORS INFLUENCING PERITONEAL INFLAMMATION

1. BACTERIAL VIRULENCE

There are numerous factors which influence the virulence of the contamination bacteria. The most common organisms that causes secondary peritonitis are aerobic coliforms, bacteroides, enterococci and anaerobes. Though there is major contamination in secondary peritonitis, only few organisms were isolated. This indicates that few bacteria survive to predominate in the infection. Weinstein demonstrated E.coli and enterococcus were the predominant organisms in peritonitis phase and bacteroides in abscess phase.

Ability of some organisms to adhere to the mesothelial surface also enhance the virulence of the organisms.

Virulence of the organism also enhanced by bacterial synergism, specifically combination of anerobic and aerobic species exhibit increased lethality compared to single species infection.

1. ADJUVANT FACTORS

Substances like gastrin mucin, bile salts and necrotic tissue inside the peritoneal cavity act like adjuvants and enhance the infection due to peritonitis.

S.NO	ADJUVANT FACTOR	EFFECTS
1	Intraperitoneal fluid	dilution of opsonins and inhibit phagocytosis
2	haemoglobin	enhance bacteria mediated inhibition of neutrophil function
3	fibrin	impair phagocytosis
4	platelets	occlusion of diaphragmatic lymphatics
5	gastric juice	induce sterile chemical peritonitis
6	bile salts	diminishes surface tension & activates complement system

SYSTEMIC INFLAMMATORY RESPONSE SYNDROME

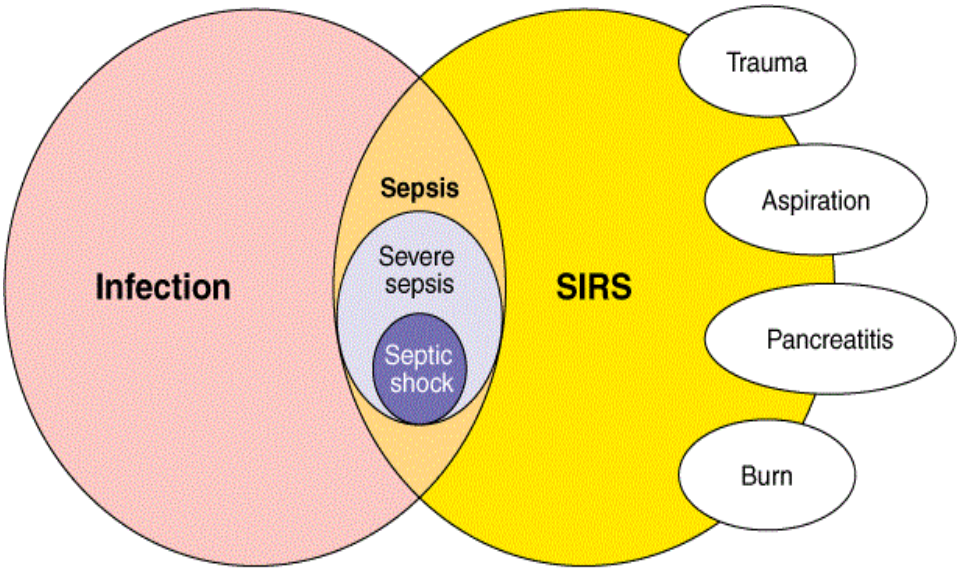
Systemic inflammatory response (SIRS) is a response elicits by the body to infectious wound. It occurs as a result of imbalance in homeostasis in the body.

Definition of SIRS

Two or more of the following has to be present to name it as SIRS

1. Temperature either >38 degree centigrade or < 36 degree centigrade.
2. Tachycardia > 90/ min.
3. Tachypnoea > 20/min
4. WBC count – either > 12000/cu mm or < 4000/cu mm

PICTORIAL REPRESETNATION OF DEVELOPMENT OF SIRS



Sepsis is combination of SIRS with identifiable infection.

Sepsis syndrome is SIRS with one or more organ dysfunction.

SIRS develops most commonly following after infectious cause like, Perforation peritonitis. But it can also result following pancreatitis, trauma or burns. Secondary peritonitis results in systemic inflammatory response by release of lipopolysaccharide endotoxin released from the gram negative cell wall of bacteria (ex. E coli).

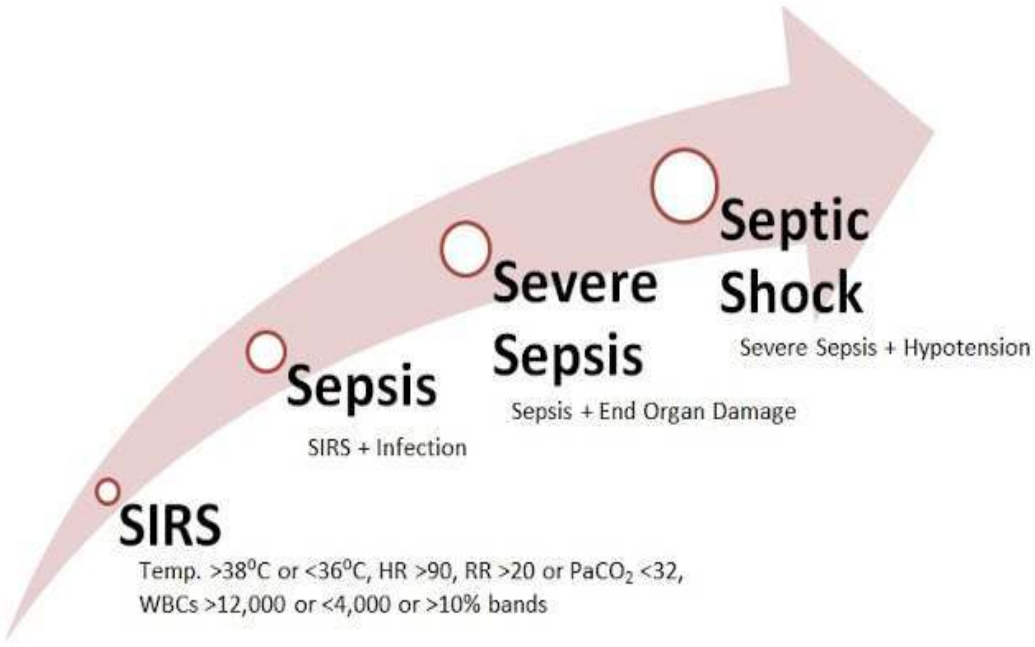
This results in release of mediators of inflammation like cytokines, leading to development of SIRS. SIRS and MODS are regulated by means of cytokines namely IL -6, interferon alpha and mediators that are secreted from phagocytes during process of inflammation.

Uncontrolled infection results in development of SIRS, which may develop into multi organ dysfunction. When the body doesn't able to control SIRS, it results in development of multisystem organ failure and death MODS.

In case of early perforation and presentation of patient to hospital, the development of sepsis and MODS is rarity.

But in our setup due lack of knowledge, there has been late presentation of perforation to hospital, in these cases development of sepsis and septic shock is common.

SEQUELE OF SYSTEMIC INFLAMMATORY RESPONSE SYNDROME



MEDIATORS OF INFLAMMATION

Though there are many mediators of inflammation. The following the important cytokines which plays a major role in inflammation.

CYTOKINES	COMMENTS
Tumour necrosis factor	Earliest mediator of inflammation, results in development of shock and catabolism
IL – 1	Induces fever through prostaglandins Promote endorphin release from pituitary
IL – 2	Acts by enhancing lymphocyte proliferation and immunoglobulin production

IL – 4	Induce B lymphocyte and production of IgG4 and IgGE (allergic reaction)
IL – 5	Increase eosinophil production
IL – 6	Increase activated neutrophil
IL – 8	Attracts neutrophils, basophils, eosinophils and lymphocyte towards site of infection
IL – 10	Important anti-inflammatory mediator
High mobility group box B1(HMG B1)	Late mediator of inflammation

MICROBIOLOGY OF PERITONITIS

Following perforation the normal microbial flora of intestine gets disturbed resulting in entry of organisms into the peritoneal cavity. The type and organism isolated will depend on the level of perforation.

The stomach and proximal which is highly resistant to microbes except for acid resistant bacteria, following perforation due to ileus there will be migration of lower gastrointestinal flora to upper gastrointestinal tract causing peritonitis.

In study by Weinstein et al it was observed that in early peritonitis the virulence is due to E.coli and in abscess stage to bacteroides.

One of the important aspect of normal flora of bowel is that it is changed in certain conditions like immunocompromised state and hospitalised patients which enables emergence of drug resistance and presence of extremely virulent organisms.

Enterococci plays significant role in polymicrobial infection and is associated with 20% of intrabdominal abscess formation. It has strong role in enhancing abscess formation and bacteraemia.

CLINCAL PRESENTATION OF PERITONITIS

Clinical examination remains the main mode of diagnosis in cases of perforation peritonitis.

symptoms

The most common symptom being abdominal pain, which is charecterised by sudden, sharp onset of epigastric pain in perforation. The sudden sharp pain later becomes diffuse, constant and burning pain following establishment of peritonitis. Anorexia is the second most common symptom that accompanies abdominal pain.

Nausea and vomiting are other frequently associated symptoms occurs due to peritoneal irritation.

Increased thirst and oliguria due to third fluid space loss.

Signs

Fever and diaphoresis

Tachycardia from hypovolemic shock and inflammatory mediators

Hypotension, hypothermia and cool extremities occurs as result of shock and third space fluid loss.

On examining the abdomen, the patient prefers to lie still and recumbent which causes less irritation of peritoneum thereby less pain. In case of generalised peritonitis there will be distension of abdomen with everted umbilicus, decreased abdominal movements with respiration, diffuse tenderness on palpation and rebound tenderness. Guarding and rigidity will be present. Bowel sounds will be sluggish or absent. Liver dullness may be obliterated in due to gas under diaphragm.

Rectal examination reveals pouch of Douglas bogginess due to peritoneal fluid or abscess.

Other systemic examination should be done to rule out other comorbid conditions.

INVESTIGATIONS

Blood investigations

Complete blood count will reveal leucocytosis.

Blood urea and serum creatinine will be elevated in case of pre renal failure.

Coagulation profile may be altered in final stages of peritonitis.

Radiological investigations

Chest and abdomen X ray erect to demonstrate air under diaphragm, obliteration of fat planes and ground glass appearance.

USG abdomen to demonstrate free fluid and ileus.

CT abdomen and pelvis – in case of suspected abscess formation.

MANAGEMENT

The objectives in treatment of secondary peritonitis are

1. Resuscitation
2. Initiation of antibiotic therapy
3. Elimination of source of bacteria
4. Reduction of bacterial innoculum
5. Continued medical support

Resuscitation

Resuscitation is an important step in the management of peritonitis. In case of peritonitis there will be profound loss of fluid in third space i.e

inside peritoneal cavity. The rapidity with which resuscitation must be done depends on the patients general condition.

The effectiveness of resuscitation can be monitored by measuring pulse rate, blood pressure and mental status. Central venous catheterisation required in case of frank sepsis, old age and renal insufficiency.

Supplemental oxygen is necessary.

Nasogastric decompression is done to decompress stomach and to prevent pulmonary aspiration.

Proton pump inhibitors should be administered to reduce acid output.

ANTIBIOTIC THERAPY

Antibiotics should be initiated as early as diagnosis of peritonitis is established. Initially empirical antibiotics are selected. The choice of antibiotic depend on 1) activity of the drug against the bacteria that is presumed to be present at the level of gastrointestinal perforation, 2) the bactericidal activity of antibiotic in infected tissue.

Though upper gastrointestinal perforations initially produce chemical peritonitis, later they cause bacterial peritonitis due to translocation of bacteria and ileus. A greater number of gram negative

bacilli were isolated in gastric and duodenal perforation following use of proton pump inhibitors.

Perforation at distal small intestine and colon result in massive peritoneal contamination. But only few dominant organism survive in peritonitis, the most common combination being E.coli, Klebsiella and bacteroides fragilis.

SURGICAL INFECTION SOCIETY GUIDELINES FOR ANTIBIOTIC TREATMENT OF ESTABLISHED PERITONITIS

SINGLE AGENT:

- Ampicillin+sulbactum
- Cefotetan
- Cefoxitin
- Meropenem
- Pipracillin- tazobactum
- Imipenem-cilastin

COMBINATION REGIMEN

- Aminoglycoside + metronidazole
- Aztreonam + clindamycin
- Cefuroxime + metronidazole
- Ciprofloxacin + metronidazole
- 3^{rd} or 4^{th} generation cephalosporins + metronidazole

DURATION OF ANTIBIOTIC THERAPHY

Duration of antibiotic administration depends on clinical circumstances and also on the clinical indicators like temperature, WBC count.

SURGICAL MANAGEMENT

Surgical management primarily directed towards control of source of infection and secondly to reduce bacterial inoculum to prevent sepsis.

In case of perforation, midline laparotomy is done and peritoneal fluid is drained. The site of perforation is identified by performing exploratory laparotomy. Most of the perforations were seen in duodenal followed by gastric region. After identifying the site, perforation is closed using live omental patch with vicryl.

After keeping abdominal drain wound closed in layers and sterile dressing is applied.

PERITONEAL FLIUD CULTURE

For isolation of organisms and identification of resistant organisms from peritoneal fluid culture were practised since 1930, where Altemeier cultures the infective fluid in perforated appendix and showed heavy contamination of aerobic and anaerobic infection on culture. Though anerobic and aerobic organisms were identified in peritoneal fluid, these

findings were found to represent either single or only couple of organisms. But with the recent observations both aerobic and anaerobic organisms can work in synergy to promote the pathogenicity of the infective process.

Moreover the practice of obtaining intraoperative peritoneal fluid for culture in patients with abdominal infections has been considered as important in providing the basis for choices and changes in postoperative antibiotic therapy. However recent studies challenged the practice and role of peritoneal fluid culture is controversial.

Till today practice antibiotic resistance is occurring at a significant rate and often associated with clinical failure. Infection of peritoneal cavity following perforation results in contamination of peritoneal cavity with bacteria, which is treated with conventional antibiotics therapy, is complicated by both by the emergence of antibiotic resistance and increased patient population intrinsically at risk for nosocomial infections. All above factors makes the surgeon to do peritoneal fluid culture intraoperatively.

Avery demonstrated that there is an increasing evidence for drug resistance to empirical drug therapy for organisms isolated in peritoneal fluid. The need for reducing antibiotic exposure and value of knowledge

obtained from observing microbial sensitivity pattern support routine need for peritoneal fluid culture.

A study conducted by Martin. J. Bell et al demonstrated polybacterial contamination of peritoneal cavity in more than half of neonates in whom cultures were taken. 23% of culture showed to have a mixed aerobic and anerobic flora. He showed the common organism isolated were E.coli and bacteroides species.

Another study done by John Boey showed E.coli, Klebsiella and pseudomonas were most common isolates in perforated duodenal ulcer where perforation has occurred two days before.

In other two studies E.coli is demonstrated as most common organism in peritoneal fluid culture in perforation peritonitis.

In study conducted by Mutiibwa, demonstrated that in order to guide in choice of antimicrobial therapy, peritoneal fluid culture in perforation peritonitis is necessary.

ANAEROBIC THERPY

The importance of anaerobic culture and antimicrobial resistance is well recognised. In routine practice antibacterial testing is regarded necessary. But whether to do for anerobic testing is a debate. Moreover most of intraabdominal infections are polymicrobial and separating anerobic from the pool is often difficult and time consuming and has less impact in clinical outcome.

The fact that empirical antibiotic theraphy for intraabdominal infection decrease the pathogenicity of these organisms rapidly, but the role of their culture is controversial.

MICROBIOLOGY :

Normally the new born baby has no bacteria in the gut. But gut is soon inoculated with bacterial flora after oral intake.

Oesophagus consists of swallowed microbes that are present in the food and saliva. It mainly consists of gram positive and negative cocci and anaerobes.

Stomach is usually resistant to microbes due to the pH of 1.5 within the stomach and presence of pepsinogen. But has acid resistant bacteria like H. Pylori and lactobacillus.

In case of altered acidity due to perforation or obstruction, it is susceptible to other bacteria also.

In small intestine due to alkaline pH the growth of microbes is enormous. This rise in pH increases microbial content as we go down the small intestinal tract. The microbial content ranges from 10^3 to 10^8. The main organism being enterococci and other faecal microbes.

Among gut large intestine has the largest inoculation of microbes. It ranges from 10^8 to 10^{11}. It mostly consists of anaerobes.

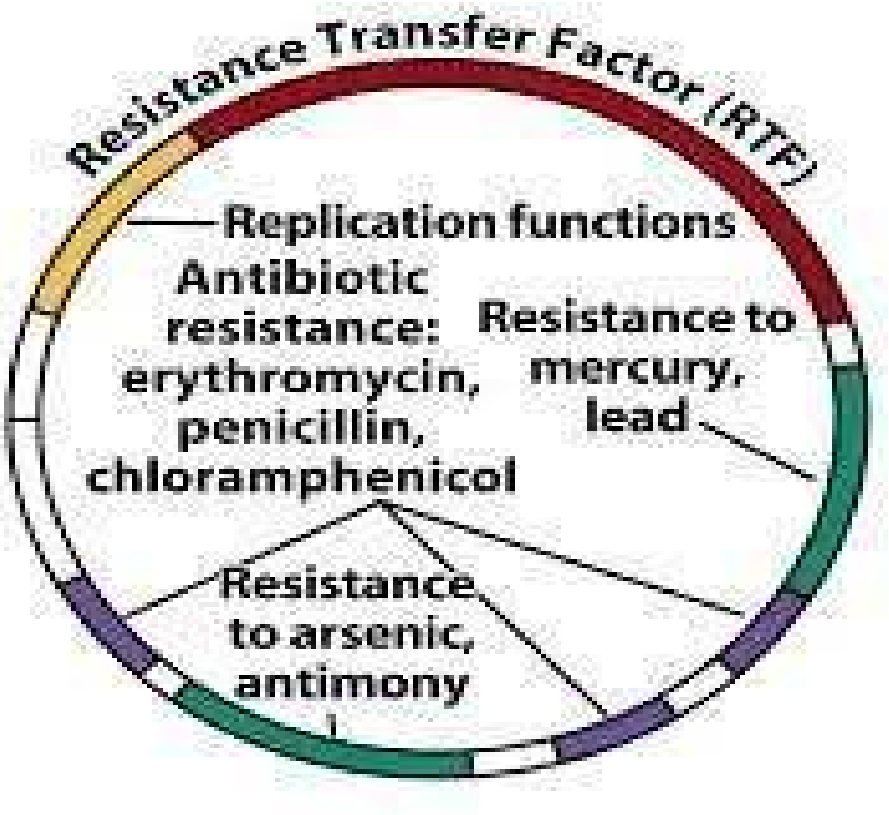
RESISTANCE TRANSFER FACTOR (RTF)

Resistance transfer factor is a plasmid present in the bacteria. It is responsible for development of drug resistance among bacteria.

Resistance transfer factor was first discovered by group of Japanese scientist in the year 1959. Resistance transfer factor was first demonstrated in the bacterial species Shigella.

They observed that patients excreting such shigella strains also shed E. Coli strains resistance to same drugs and they found out that this development of resistance is due to plasmid mediated conjugation. This mechanism of drug resistance is called as infectious drug resistance.

PICTORIAL REPRESENTATION OF RESISTANCE TRANSFER FACTOR



R factor is a plasmid. It consists of 2 components 1. RTF 2. 'r' determinants. RTF is responsible for conjugational transfer while each ' r' determinant carries resistance for one of the several drugs. Most of the times, the R factor carries both RTF as well as 'r' determinant and results in development of resistance in other bacteria by conjugation. Sometimes RTF and 'r' determinants are separate and this has no ability to transfer resistance to another bacteria, though it has both factors.

Resistance transfer factor is not only helpful in transfer of resistance but also helpful in transfer of enerotoxin and hemolysin from one bacteria to another.

This infectious or transferable drug resistance is seen in bacteria such as E coli, Proteus, Klebsiella and Pseudomonas.

Transferable drug resistance occurs readily in in vitro conditions but is inhibited inside the intestine by factors such as presence of bile salts, alkaline pH, anaerobic condition and presence of anaerobic bacteria.

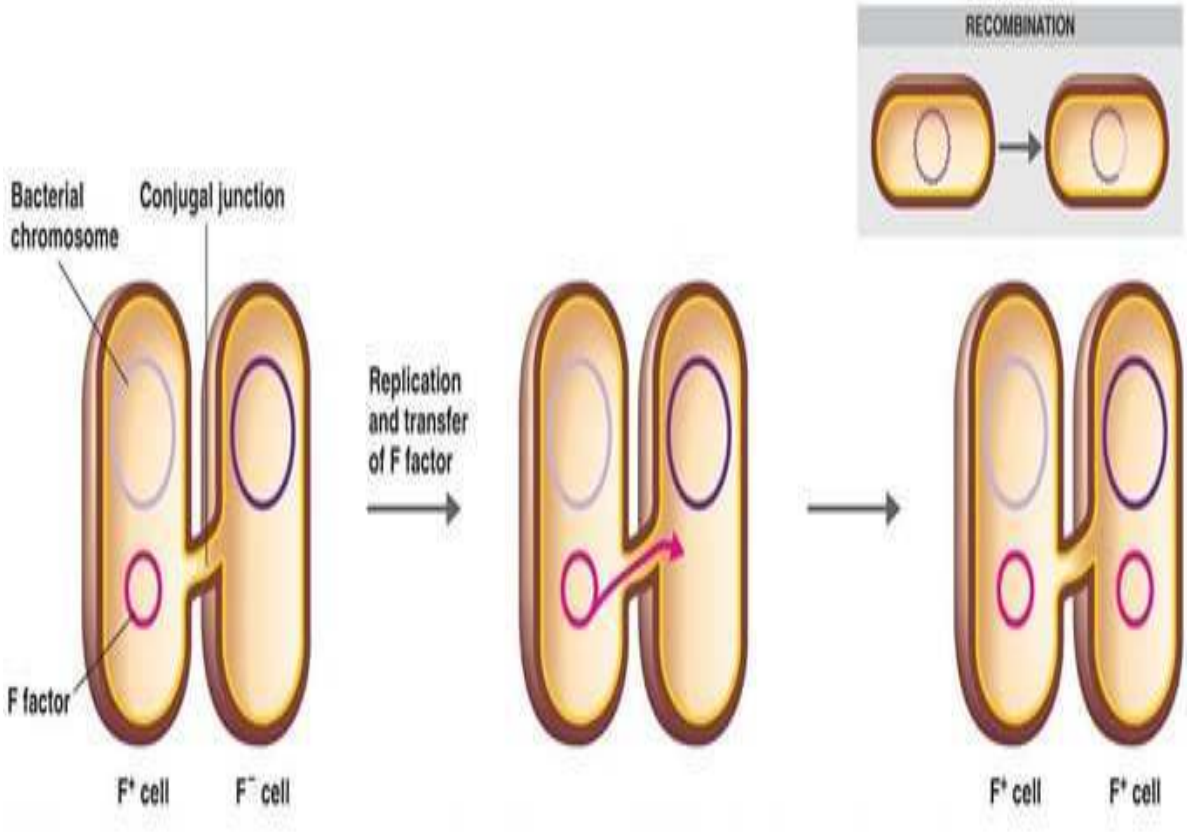
Bacteria carrying R factor can be transferred from animals to man. So indiscriminate use of drugs in animal can also result in development of drug resistance in the human community.

GENETIC MECHANISM OF DRUG RESISTANCE

Bacteria have the ability to develop resistance by mutation or by transfer of gene from one bacteria to another. These genes can be transferred from one to another by either conjugation or transformation or transduction. Of the above three the most common method for resistance gene transfer is being conjugation. Conjugation mode of drug resistance is seen in case of Mycobacterium tuberculosis bacteria. Mycobacterium tuberculosis has the capacity to develop multidrug resistance by means conjugation.

Transferable drug resistance by R factor is important mode of drug resistance.

Resistance by transduction can also occur. It is seen in case of transfer of penicillin resistance Staphylococcus to susceptible Streptococcus by transduction. Resistance by transformation can also occur, but is not common.



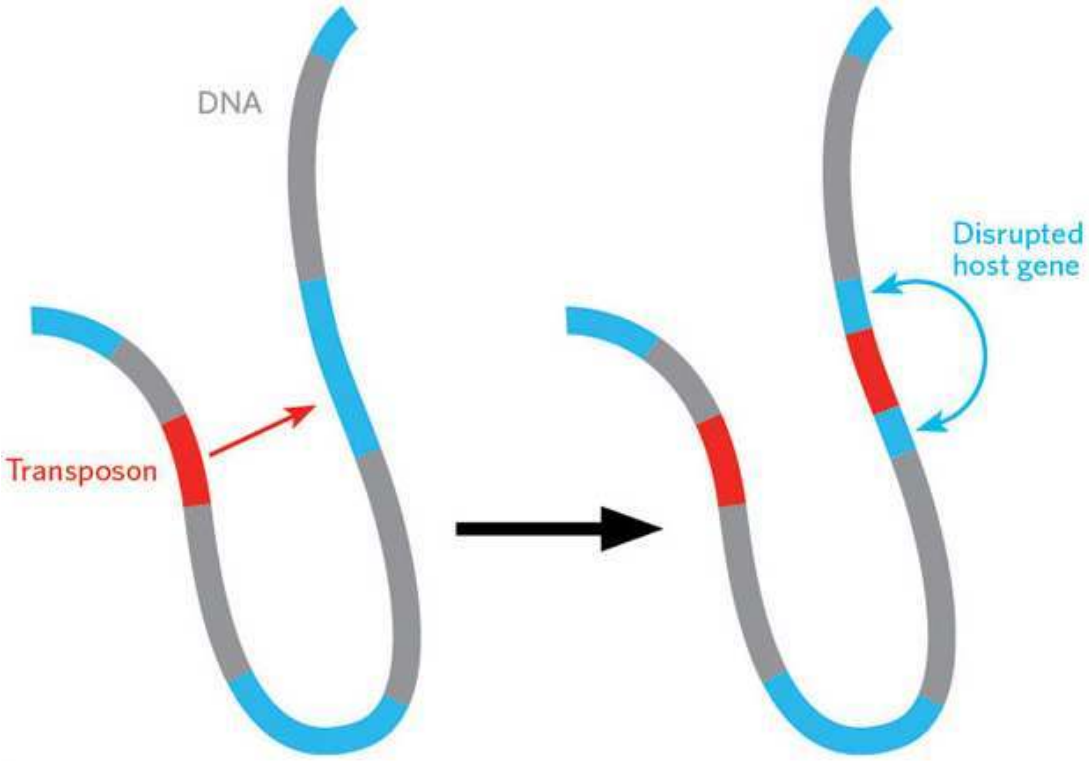
DIFFERENCE BETWEEN MUTATIONAL AND TRANSFERABLE RESISTANCE TO DRUG

MUTAIONAL DRUG RESISTANCE	TRANSFERABLE DRUG RESITANCE
Resistance occurs to single drug only	Resistance to multiple drugs simultaneously
Low degree of resistance	High degree of resistance
Resistance is not transferable	Resistance to transferable to another organism
Mutants can be defective	Mutants are not defective
Virulence of resistance by mutants may be decreased	Virulence is not decreased
It can be prevented by using combination of drugs	Not prevented by combination of drugs
Mutational resistance	Transferable resistance

TRANSPOSABLE GENETIC ELEMENTS

Transposition is a method by which genetic information from DNA from one bacteria is transferred to another. It is different from recombination in the fact it does not require any DNA homology between transposable element and site of insertion.

Transposable genetic elements are sequence of DNA segment. It has the capacity to move from one plasmid to another or from plasmid to chromosome or within chromosome. Because of their capacity to jump from one place to another it is also called as jumping genes.



These transposable genetic elements are of two categories 1. Transposons and 2. Insertion sequences.

Transposons are made up of 4- 25 kb transposable genetic material. It is defined as segment of DNA which has one or more genes in centre with both ends carrying inverted repeated sequence which is

complemwntary to each other. Due to this feature , each transposon has single strand loop with double strand stem.

Small transposons 1-2kb are called as insertion sequence or IS elements.

Transposons have the capacity to bind to certain regions of chromosome or plasmid or phage DNA. By addition of these transposons to bacteria they acquire certain characters. Transposons doesn't have the capacity of self replicating, but can replicate by attaching with plasmid or DNA.

There has been one theory which states that R factor develops as a results of collection of transposons , each carrying gene that has resistance to drugs.

MODE OF ACTION OF ANTIBIOTIC DRUGS:

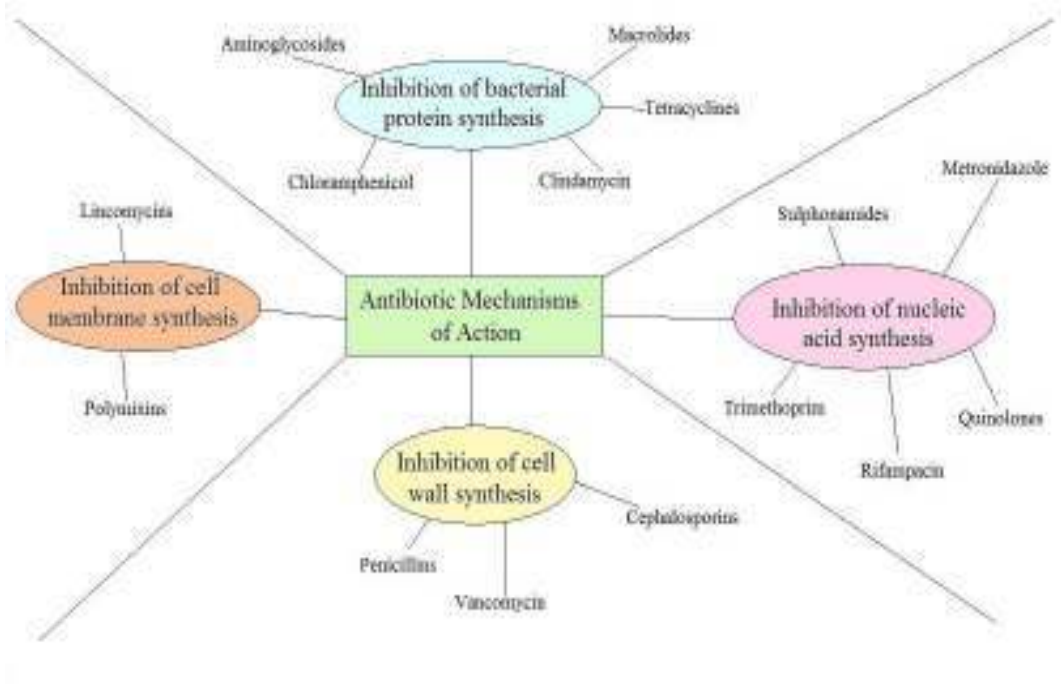
There are 4 ways by which these drugs act

(1) Cell wall synthesis inhibition

(2) Disruption of cell membrane

(3) Affecting protein translation and transcription

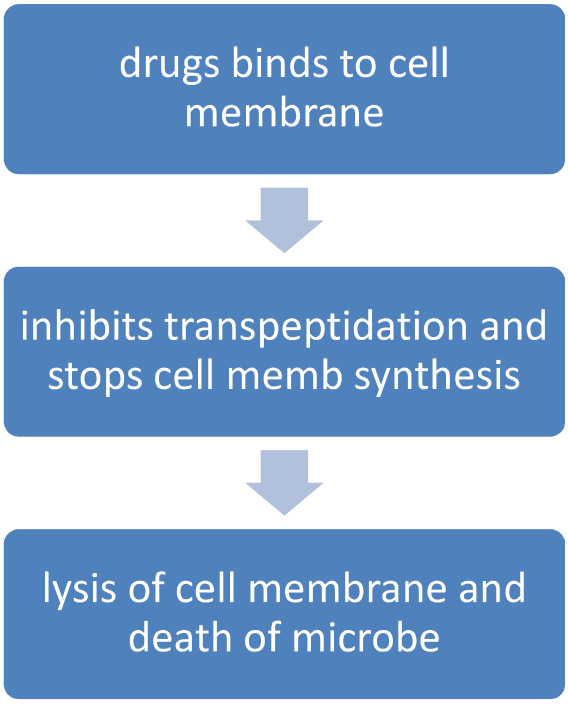
(4) Inhibition of nucleic acid synthesis.



CELL WALL SYNTHESIS INHIBITION :

The bacterial cell wall is composed of peptidoglycan molecules. These peptidoglycan is highly cross linked and provides rigidity and stability to cell wall. Beta lactum antibiotics act by inhibiting the formation of cell wall synthesis in bacteria. This results in lysis of bacteria, resulting in the bactericidal activity of the drug

Examples of betalactum antibiotics were penicillins and cephalosporin group of drugs.



CELL MEMBRANE DISRUPTION BY AFFECTING ITS FUNCTION

These drugs bound to cell membrane causing membrane disruption resulting in escape of intracellular ions causing cell disruption.

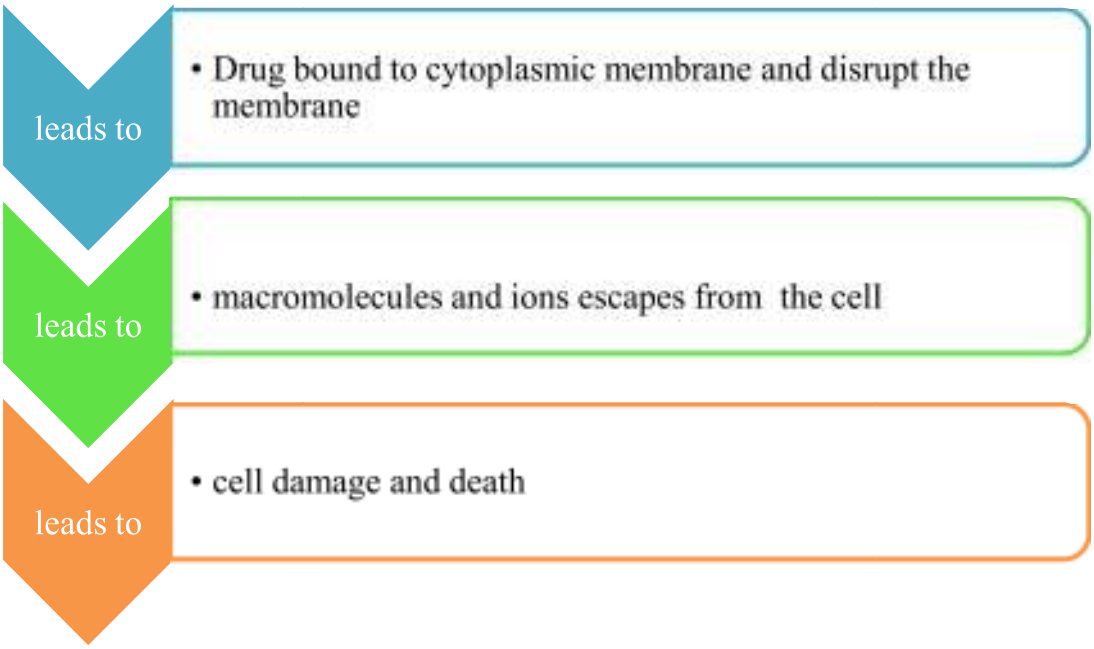
The bacterial and fungal cytoplasmic membrane has structural difference from that of human cytoplasmic membrane so selective chemotherapy occurs .

They include valinomycin,

amphotericin B,

colistin, and

imidazoles and triazoles.



INHIBITION OF PROTEIN SYNTHESIS:

These group of drugs act by binding to the specific units of the ribosome and act by inhibiting the transcription and translation process thereby eventually inhibiting the protein synthesis of the bacteria

These group of drugs don't kill the bacteria but prevent its replication so they are called as bacteriostatic.These group includes

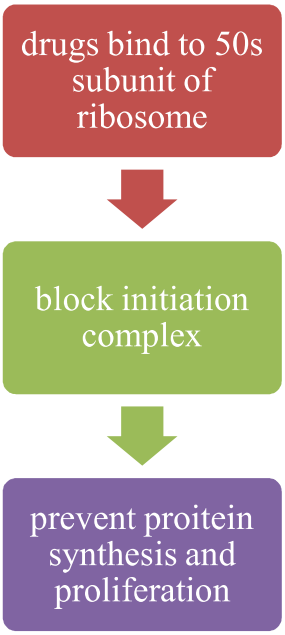
Macrolides,

Azalides,

Ketolides

MACROLIDES, AZALIDES, KETOLIDES

These group of drugs act on 50s subunit of ribosome.



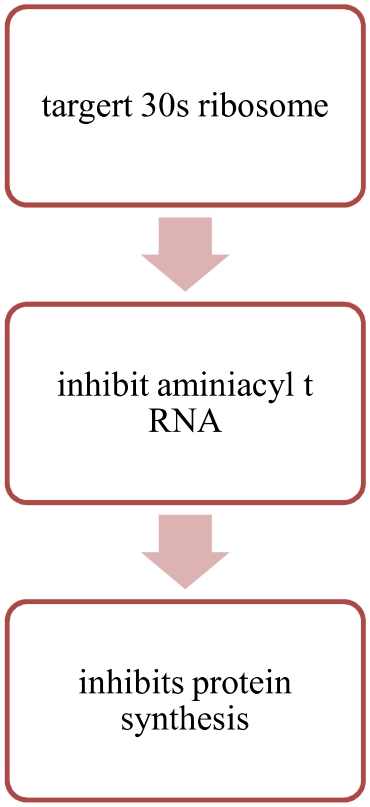
TETRACYCLINES

These are broad spectrum antibiotics.

They consists of 4 cycles of napthacene derivative ring in their molecule.

These group of drugs bind to 30s ribosome of RNA and it blocks amino acid synthesis . Thereby causing bacteriostatic effect.

They are active against both gram positive and gram negative bacteria.



This results in inhibition of proliferation resulting in bacteriostatic effect. But it is an reversible blockade.

There are 3 ways by which resistance develops in case of tetracyclines

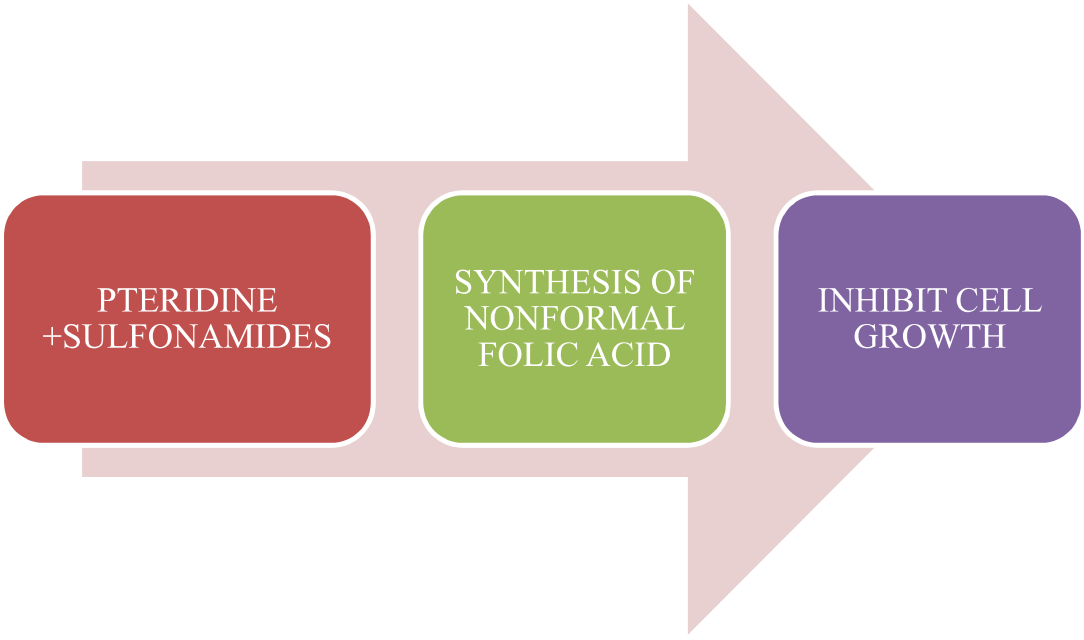
1. Efflux pumps
2. Ribosomal protection
3. Chemical modification.

INHIBITION OF NUCLEIC ACID PRODUCTION:

Quinolone group of drugs acts by blocking DNA synthesis of microbes by affecting DNA gyrase enzyme.

Trimethoprim inhibits DHF reductase present in the bacterial cells. DHFR reduces dihydrofolic to tetrahydrofolic acid, leading to the synthesis of purines and ultimately DNA. By blocking this enzyme synthesis of DNA is affected resulting bacteriostatic effect.

Sulfonamides similar to PABA structurally and inhibit dihydropteroate synthetase. The action of sulfonamides on bacterial growth can be reversed by excess of PABA in the environment (competitive inhibition).



DEVELOPMENT OF DRUG RESISTANCE TO ANTIBIOTICS

Microorganism tries to escape the action of antibiotics in 5 ways. They are

1. Production of enzyme that deactivates the antibiotic.

   Ex: beta lactamase enzyme production to penicillins.

2. Barrier to entry of drug inside the cell. Most of gram negative bacteria exhibit resistance through this mechanism.
3. Change in target protein for the antibiotics
4. Developing new route of metabolic pathway instead of routine pathway.

   Ex: bacteria starts using preformed folic acid, that are resistant to sulphonamides.

5. Development of enzyme that has functionally similar but not inhibited by antibiotic.

   Ex: DHF reductase and bacteria that are resistant to trimethoprim.

DOCTORS AND ANTIBIOTIC RESISTANCE

Doctors have an important part in development of resistance for antibiotics among bacteria. It is due to their prescribing habit regarding antibiotics. They also play a role in cross infection from one patient to another.

GRAM NEGATIVE ANTIMICROBIAL RESISTANCE AND EXTENDED SPECTRUM BETA LACTAMASES

The knowledge regarding development of antimicrobial resistance among enteric bacteria in case of peritonitis is important in treating the patient.

These enteric gram negative bacilli has many ways of development of resistance to antimicrobial drugs. These gram negative bacilli were initially sensitive to beta lactum antibiotics, but due to production of enzyme beta lactamases these bacteria develops resistance to antibiotics with beta lactum ring like penicillin and other antibiotics with beta lactum ring. There are many beta lactamases which has different specificity and host susceptibility. The early generations of cephalosporins are also susceptible to action of betalacatamases produced by bacteria. Due to development of resistance to penicillin and cephalosporin group of drugs,

much of importance has been given to development of betalactamase inhibitors like clavulanic acid.

Modifications of structure among cephalosporins like cefotetan, prevents the action of betalactamases enzyme. The newer generation cephalosporins like cefotaxime have better stability against beta lactamases. These drugs were used frequently due to its better pharmacokinetics and safety. These agroup of drugs also developed resistance to betalactamases which are chromosomally mediated.

Development of resistance to cephalosporins were reported in 1980's in Europe among gram negative bacteria like Klebsiella species and E coli which are initially susceptible to beta lactum antibiotics. The drug resistance among these bacteria developed through transfer of plasmid from one bacterium to another which carries the factor for drug resistance.

Due to over usage of newer generation cephalosporins among the enteric bacteria, they started developing extended spectrum beta lactamases. It results in development of wider range of antibiotic resistance. These difficulties have been overcome by discovery of betalactamase inhibitors like clavulanic acid, sulbactum and tazobactum.

Among the betalactamase inhibitors clavulanic acid and tazobactum have good inhibitory activity against beta lactamases.

But recently there has been bacteria which are identified to be resistant to extended spectrum betalactamases.

The role of development of resistance by anaerobic bacteria were primarily due to production of betalactamase. But they can also develop resistance by inactivating enzymes like acetyl transferase and plasmid mediated resistance. But drugs with 100% activity to most of anaerobic bacteria are imipenem, metronidazole and combination of beta lactum with beta lactamases inhibitors.

RELEVANT STUDIES

1. AEROBIC BACTERIAL CAUSES OF SECONDARY PERITONITIS AND THEIR ANTIBIOTIC SENSITIVITY PATTERN IN NON TRAUMATIC SMALL BOWEL PERFORATION

D. Mutiibwa, G.Tumusiime et al, East cent Afr J Surg, july 2013

Method : cross sectional study done in Mbara regional referral hospital which included 87 patient with non traumatic small bowel perforation. Peritoneal fluid was analysed for all patients enrolled in the study

Results: most of patients had klebsiella spp (37.9%) followed by E coli (26.4%) and 13.8% had no growth. Most organisms were susceptible to ceftriaxone followed by ciprofloxacin and gentamycin.

2. WHETHER CULTURE POSITIVITY AND PERFORATION OPERATION INTERVAL AFFECTS MORTALITY IN PERFORATION PERITONITIS?: EXPERIENCE OF RURAL COLLEGE

Dr aslam, Dr. Vinod, Dr shashikant, Indian Journal of Basic and Applied Medical research, March 2015, volume 4

METHOD: This study was conducted in Bharathi Vidyapeeth University, Bharathi medical college. It included 276 cases of perforation peritonitis and was conducted over a period of 8 yrs and studied the correlation of mortality to various organism to perforation operation interval.

RESULTS: Out of 276 cases , 130 yielded positive culture and 146 negative culture. The mortality rate in culture negative cases was 4.1% and positive cases was 25.8%. This study concludes that postoperative interval and culture positivity of peritoneal fluid has direct bearing on mortality.

3. APPENDECTOMY IN PEDIATRICS THE VALUE OF PERITONEAL FLUID SMEAR AND ITS BACTERIOLOGICAL PROFILE

   Dr. Manal, Al-Qadisiya University, DIwaniya, Open journal of medical microbiology, 2012,2.

   METHOD: This is prospective descriptive study included 54 children with appendicitis, peritoneal fluid samples from appendicular fossa were taken during surgery.

   RESULTS: 74.07% had positive culture and study concludes that the routine use of peritoneal culture swabs have significance.

4. PERITONEAL FLUID CULTURE AND ANTIBIOTIC TREATMENT IN PATIENTS WITH PERFORATED APPENDICITIS IN PACIFIC ISLAND

   Dr. Alexia, Dr Herve, et al, Asian journal of Surgery 2015 xx, 1-5

   METHOD: This prospective study was conducted in Pastuer Institute in New Caledonia. It included 144 cases of appendicitis. Peritoneal fluid were sent for microbiological assessment.

   RESULTS: peritoneal fluid culture yielded positive culture in 74% cases. The most common organism cultured being Escherichia coli 81% followed by Streptococcus milleri 12%. This study concludes that infectious complications were common in group with unsuitable antibiotics, which necessitates the routine culture of peritoneal fluid.

5. NON TRAUMATIC TERMINAL ILEAL PERFORATION

   Dr. Rauf , Dr Fazl, et al, World Journal of Emergency surgery

   METHOD: This prospective study was conducted to find out etiology and management of patients with terminal ileal perforation

RESULTS: Out of 79 cases, the cause for perforation due to enteric fever was 62%, non specific inflammation was 26% and tuberculosis was 4%.

6. METRONODAZOLE IS STILL THE DRUG OF CHOICE FOR TREATMENT OF ANAEROBIC INFECTIONS

Dr. Sonja, Dr. Charlotta, et al, karolinska institute, Sweden

This study shows that metronidazole is still the standard therpy for treating anerobic infections and also cost effective and has favourable pharmacodynamic and kinetic properties.

MATERIALS

DESIGN OF STUDY: Cross sectional study

PLACE OF STUDY: Coimbatore Medical College and Hospital

STUDY PERIOD: AUGUST 2014-JULY 2015

STUDY POPULATION: Patients presenting to Coimbatore medical college hospital with perforation peritonitis.

SAMPLE SIZE: 50

INCLUSION CRITERIA:

1. Patient presenting with features of perforation peritonitis and confirmed by x ray
2. Age more than 18 yrs

EXCLUSION CRITERIA:

1. Patient presenting with primary peritonitis
2. Peritonitis due to trauma

METHODOLOGY

PRE OPERATIVE EVALUATION

Patients with features of perforation peritonitis presenting to casualty to Coimbatore medical college were admitted. Following which detailed history were taken and complete physical examination were done and diagnosis is confirmed using chest and abdomen X ray erect which shows air under diaphragm. Following which routine investigations like CBC, Blood urea and sugar and serum creatinine and electrolytes and ECG were done. Patients were excluded on the basis of above criteria. Following confirmation of diagnosis patients were planned for emergency laparotomy and perforation closure.

PREOPERATIVE PREPARATION

Patient confirmed with diagnosis of perforation peritonitis were resuscitated with intravenous fluid and stabilising the patient vitals were planned for emergency laparotomy and taken up for surgery after getting consent from the patient and his/ her attenders.

INTRAOPERATIVE PROCEDURE

Emergency laparotomy done using midline incision and peritoneal fluid was obtained from confirmed non traumatic cases and sent for aerobic microbiological culture. Following which perforation closure is

done using vicryl with live omental patch and abdomen is closed after keeping abdominal drains.

POST OPERATIVE CARE

Following surgery patient were given routine postoperative care with intravenous fluids and antibiotics. Peritoneal fluid culture reports were followed up and the isolated organisms were tested for antimicrobial sensitivity by Kirby-Bauer disc diffusion method using ampicillin, amikacin, ciprofloxacin, ceftriaxone and cotrimoxazole and the culture reports were obtained. Antibiotics were changed according to the sensitivity pattern of organism grown in the culture.

LIMITATION OF THE STUDY

1. Study population is small
2. Shorter duration of study

OBSERVATION AND RESULTS

AGE DISTRIBUTION

Age	Number
20 to 30 yrs	13
31 to 40 yrs	18
41 to 50 yrs	10
>50 yrs	9

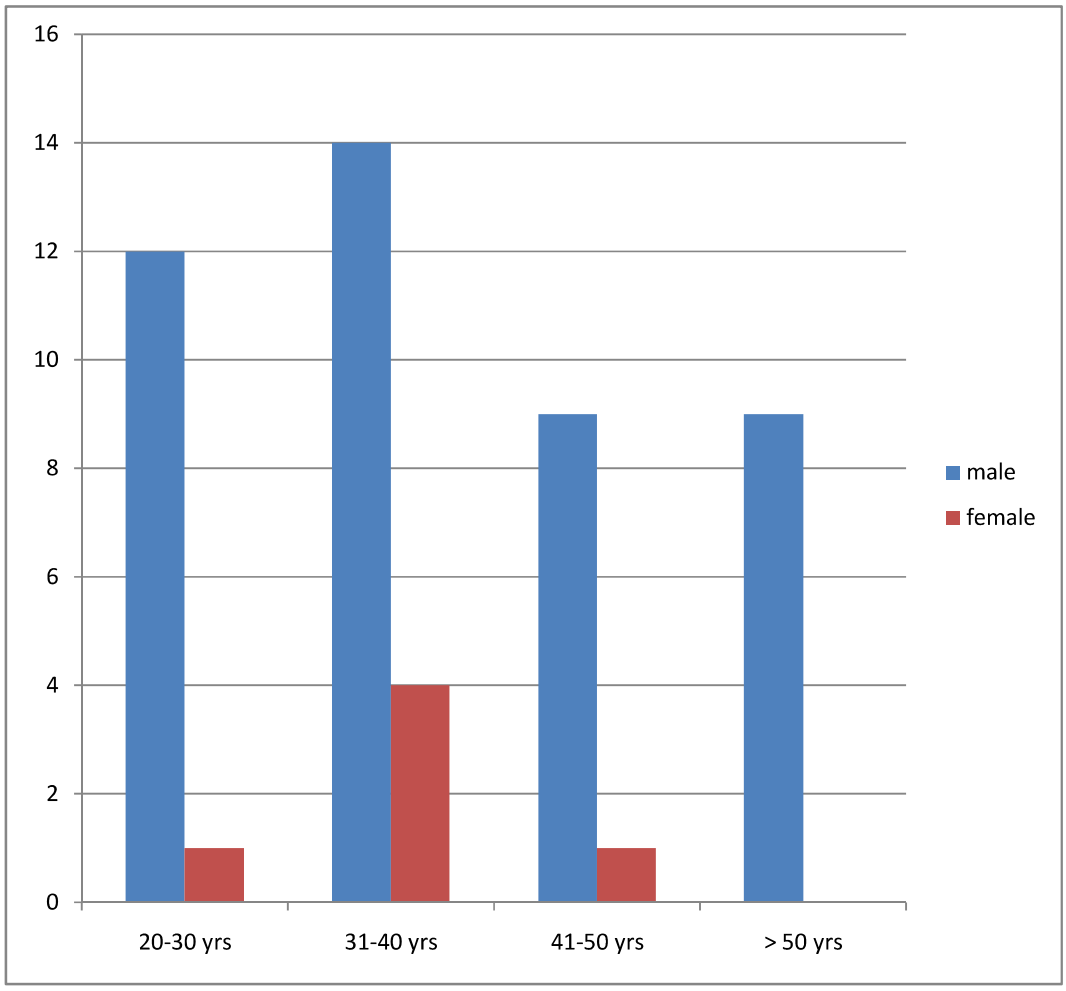
This study shows that the most common age group of presentation is about 31 to 40 yrs (36%) followed by 20 to 30 yrs (26%). The mean age of presentation is being 35.26 yrs.

SEX DISTRIBUTION

Sex	Number
Male	44
Female	6

The sex distribution in this study shows perforation being more common in male (88%) than female (12%). This finding is comparable to most of the related studies.

AGE AND SEX DISTRIBUTION

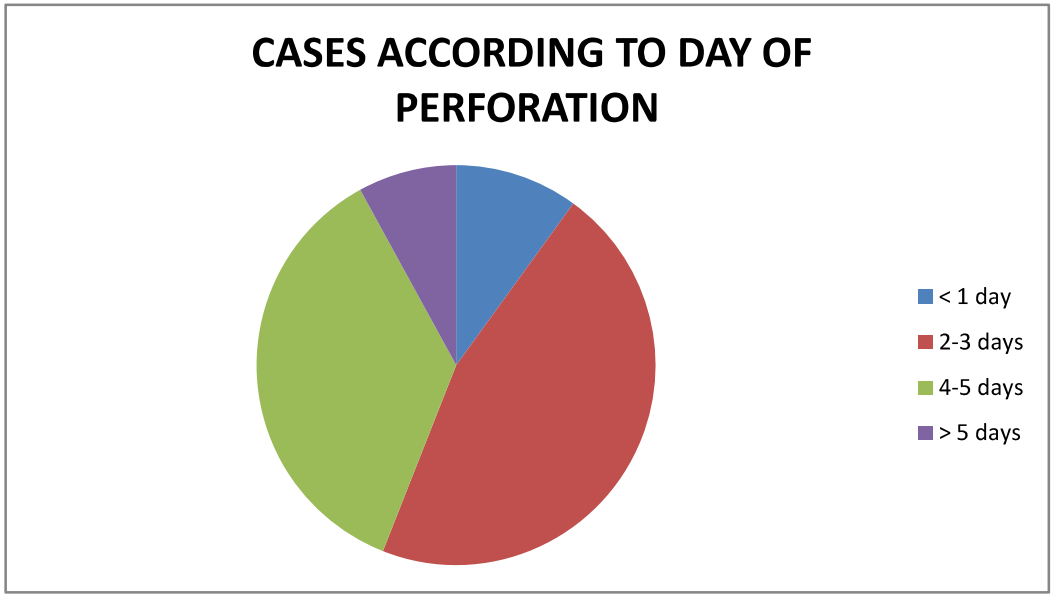


This graph shows that most of perforation occurs in age group of 30-40 yrsof age and in male population. The reason behind occurrence in men is most likely due to their food habit, alcoholism and smoking.

DURATION OF SYMPTOMS:

Duration	Number of cases
<1 day	5
2 to 3 days	23
4 to 5 days	18
>5 days	4

This study shows that the most of the cases presented to us with symptoms of perforation after 2 to 3 days which is 46 % followed by 4 to 5 days which is about 36%. The mean duration of symptoms was about 2.66 days. This finding is less when compared to mean of 6.2 days in study conducted by Mutiibwa.

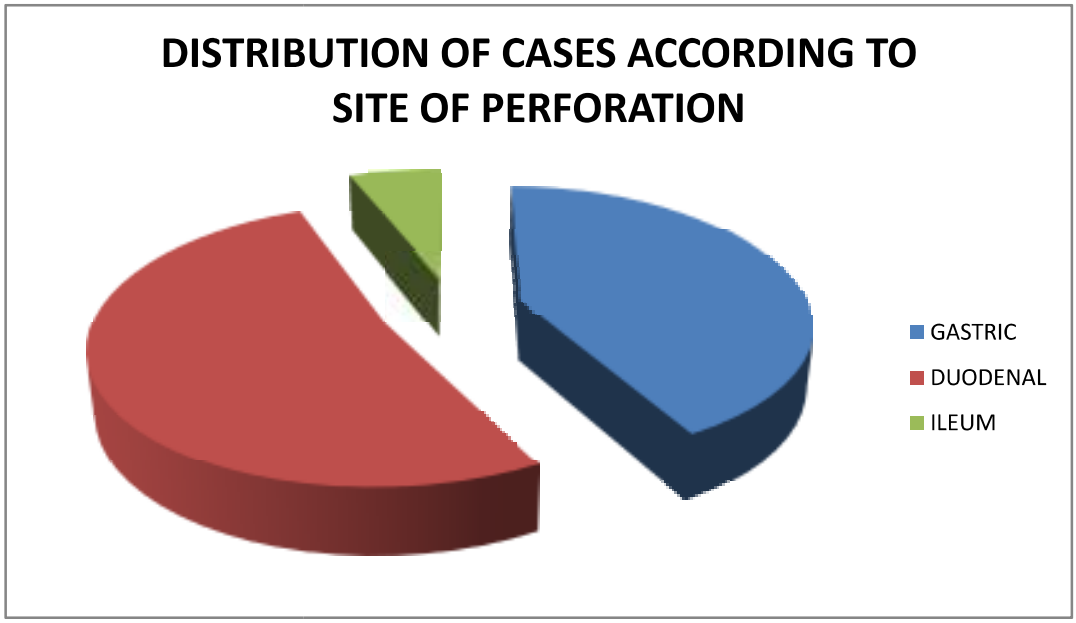


SITE OF PERFORATION:

Site	No of cases
Gastric	21
Duodenal	26
Ileal	3

This study shows that the most common site of perforation being duodenal 52% followed by gastric which is 42% and ileal perforation of 6%.

And all the cases of duodenal and gastric perforation were due to peptic ulcer disease sequel.



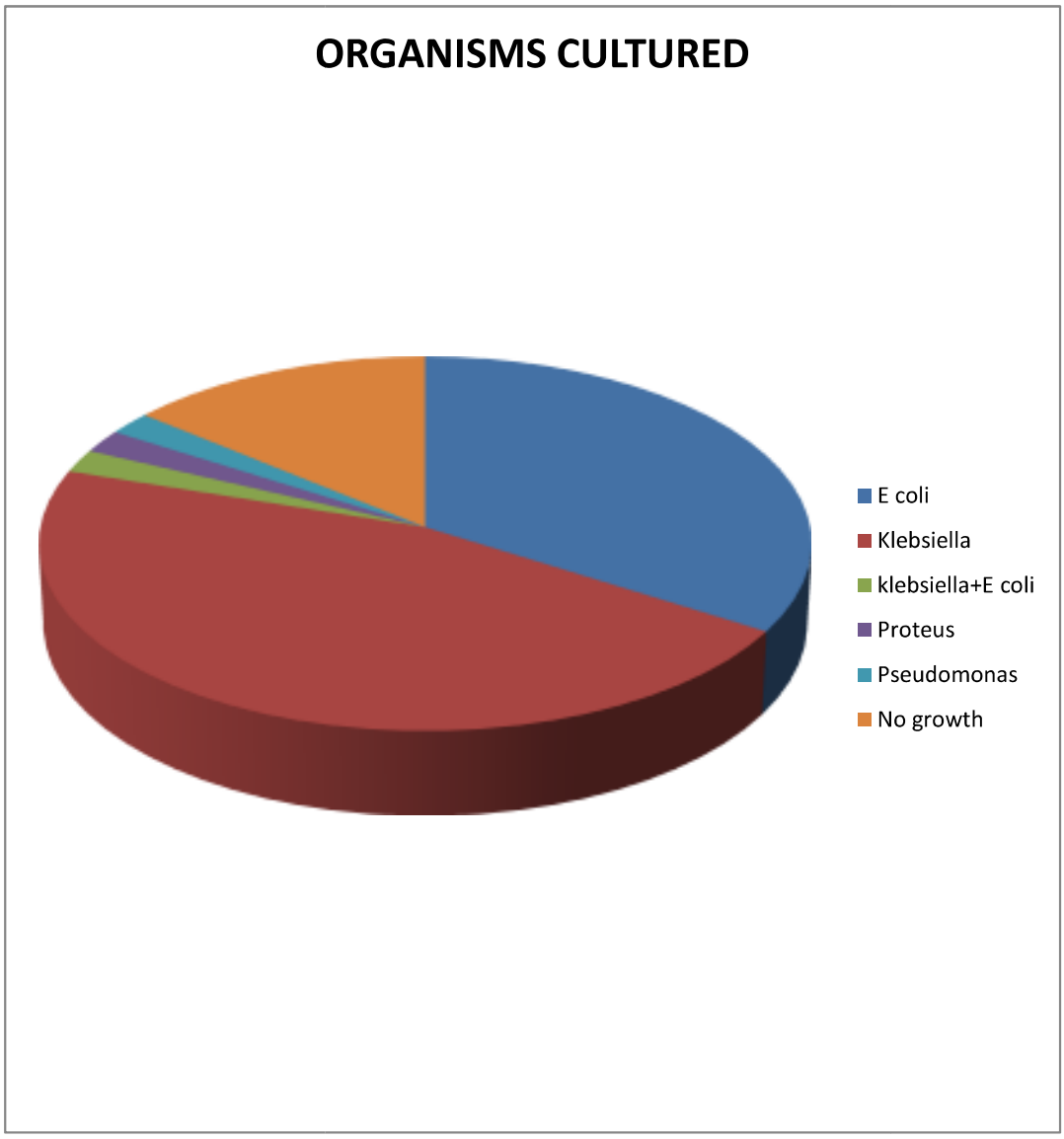
CULTURED ORGANISMS:

Organisms	No of cases grown
E coli	17
Klebsiella	23
Klebsiella + E coli	1
Proteus	1
Pseudomonas	1
No growth	7

In this study, out of 50 cases, the most common organism grown is Klebsiella species (46%) followed by Escherichia coli (34%) and no growth in about 14%.

In three cases of perforation, there was growth of proteus, pseudomonas and combination of E coli and Klebsiella in their culture.

The above results were more or less similar to the study conducted by D. Mutiibwa et al on aerobic bacterial causes of secondary peritonitis and their antibiotic sensitivity pattern which showed, Klebsiella species being 37.9% and Escherichia coli 26.4% and no growth 13.8%.


ORGANISMS CULTURED
E coli
Klebsiella
klebsiella+E coli
Proteus
Pseudomonas
No growth

ORGANISMS CULTURED ACCORDING TO SITE OF PERFORATION

	Gastric	Duodenal	Ileum
E coli	5	12	-
Klebsiella	12	9	2
Proteus	-	1	-
Pseudomonas	-	-	1
Mixed	-	1	-
No growth	4	3	-

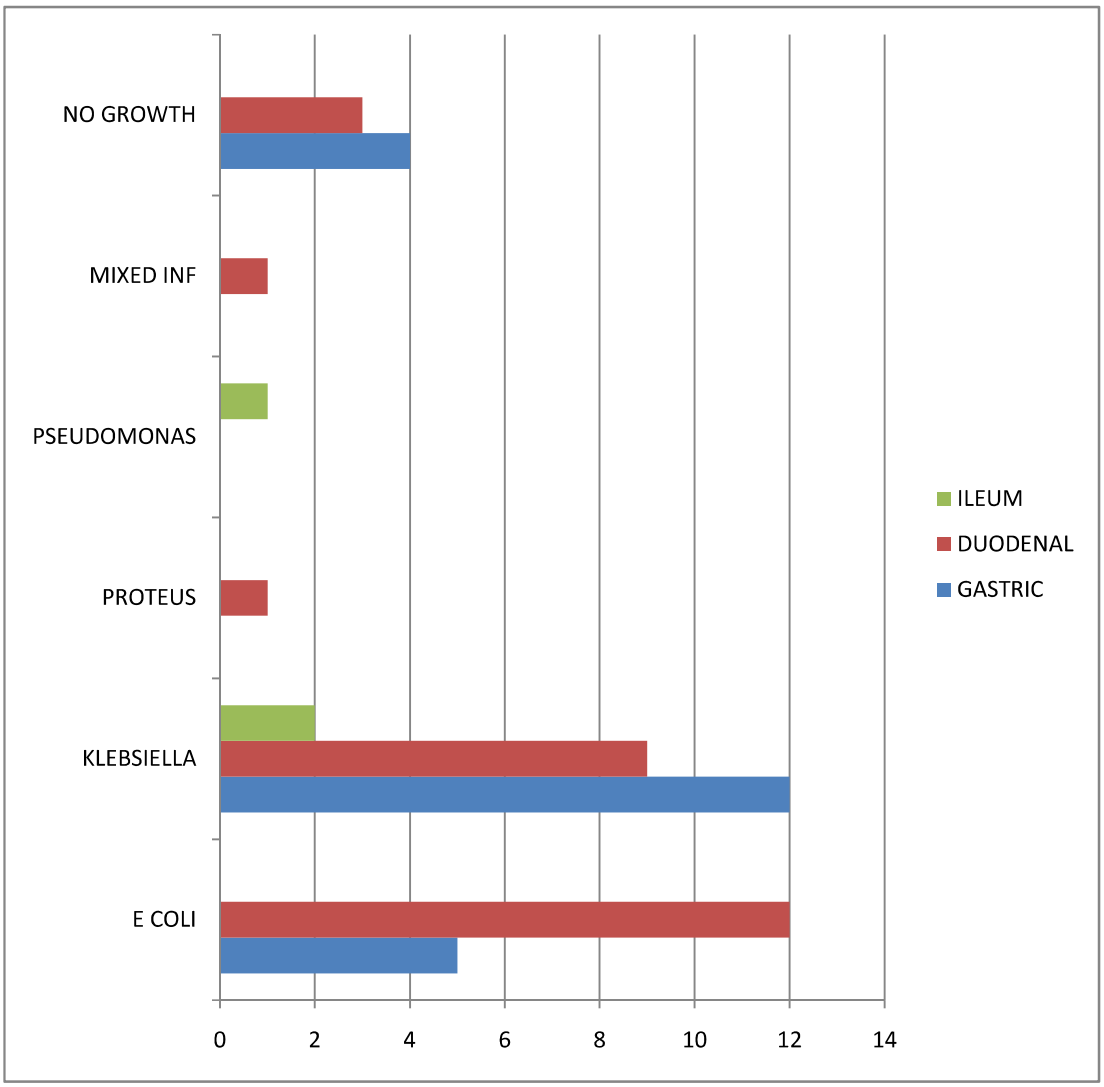
This study shows that the most common organism grown in gastric perforation was Klebsiella followed by E coli.

In case of duodenal ulcer perforation E coli being most common 12 cases followed by Klebsiella in 9 cases and proteus in 1 case and mixed growth in 1 case.

In case of ileal perforation, the common species being Klebsiella followed by pseudomonas.

Most of the perforation presented to us after 2 to 3 days.

ORGANISMS GROWN ACCORDING TO SITE OF PERFORATION



ORGANISMS AND DAY OF PERFORATION

	Day 1	Day 2-3	Day 4-5	>5 days
E.coli	-	9	8	-
Klebsiella	-	11	9	3
No growth	5	2	-	-
Proteus	-	-	1	-
Pseudomonas	-	1	-	-
mixed	-	-	-	1

This study shows that the most common organism grown during day 2 to 3 of perforation was Klebsiella (11cases) followed by Escherichia coli (9 cases). And most common organism during day 4 to 5 of perforation was also Klebsiella (9 cases) followed by Escherichia coli (8 cases). In day 1 of perforation most of the cultures were negative for growth.

In case of perforation, with 5 days old at presentation most had Klebsiella species in their culture followed by mixed infection.

Overall the most common organism being Klebsiella followed by E coli in culture growth in perforation cases.

SENSITIVITY PATTERN FOR COMMON ANTIBIOTICS

	E.COLI N=16	KLEBSIELLA N = 23	PROTEUS N= 1	PSEUDOMONAS N=1
Ampicillin	2	1	-	-
Ciproflox	13	17	1	1
Ceftriaxone	14	21	1	1
Cotrimoxazole	1	2	-	1
Amikacin	13	18	-	1

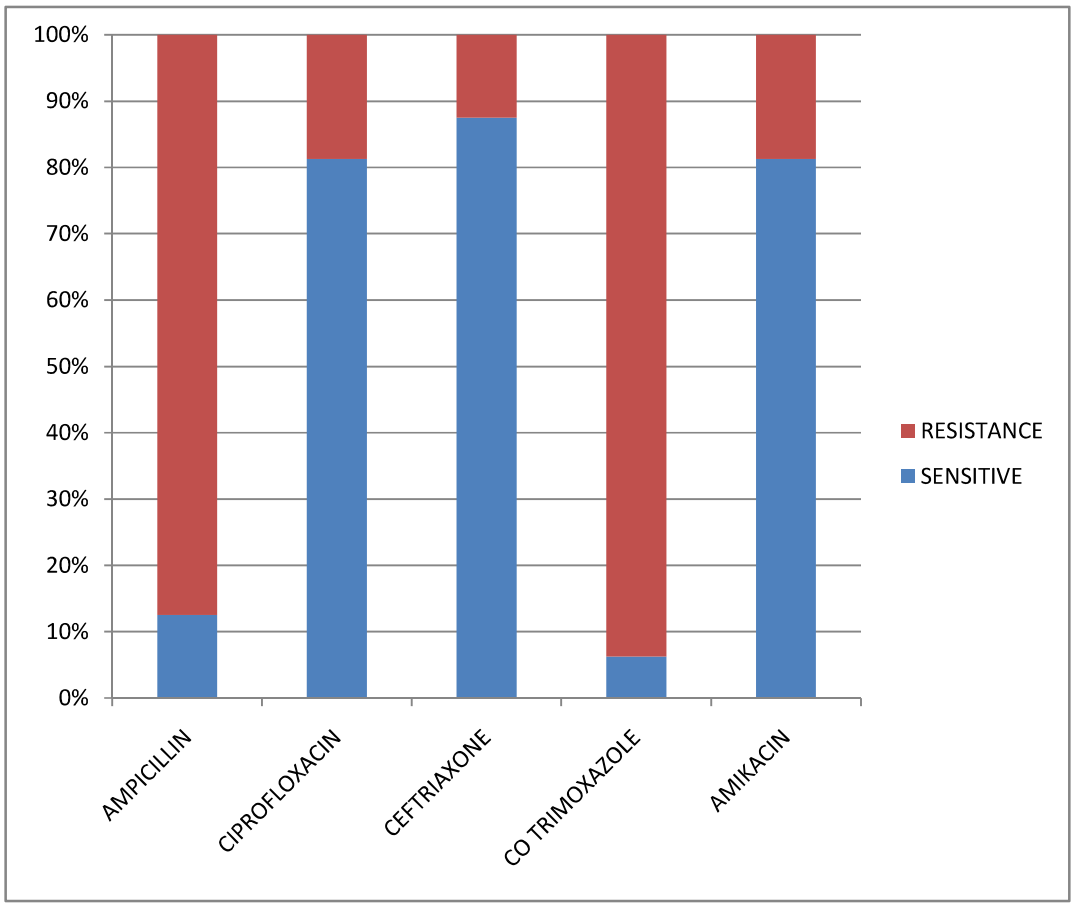
This study shows that E. Coli being sensitive in most cases to ceftriaxone (87.5%) followed by ciprofloxacin and amikacin (81.25%).

For klebsiella, ceftriaxone being more sensitive 91.03% followed by amikacin 78.2% and ciprofloxacin 73.9%.

Both Klebsiella and Escherichia coli were resistant to ampicillin and cotrimoxazole.

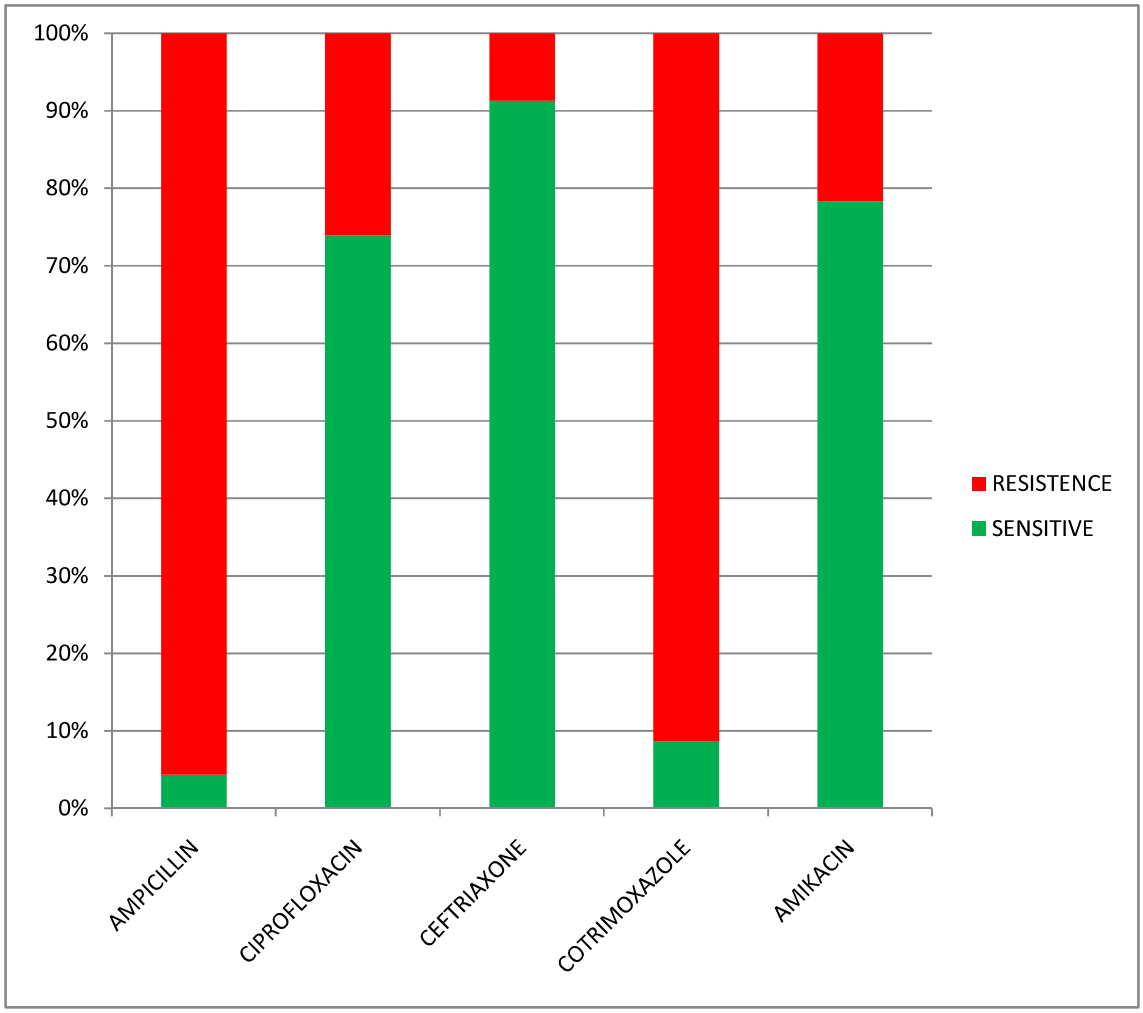
Proteus and pseudomonas species which are less commonly found in peritoneal cavity in case of perforation peritonitis are sensitive to ceftriaxone and ciprofloxacin. But proteus are resistant to amikacin.

SENSITIVITY PATTERN FOR E COLI



This chart shows the sensitivity pattern of E coli, which shows that the most common antibiotic sensitive is ceftriaxone followed by ciprofloxacin and amikacin. And is resistant to ampicllin and cotrimoxazole in most cases. There has been mild increase in resistance to ciprofloxacin and amikacin.

SENSITIVITY PATTERN FOR KLEBSIELLA



This chart shows sensitivity and resistant pattern of Klebsiella which shows that these species were susceptible to ceftriaxone group of drugs in most of the cases followed by amikacin and ciprofloxacin in the order. These bacteria in most of the cases showed resistance to ampicilin and cotrimoxazole.

DISCUSSION

Secondary peritonitis caused by hollow viscus perforation is common. It has high mortality rate due to late presentation of patient to hospital.

In our study secondary peritonitis due to perforation was common in males than females, which is in the ratio of 7:1. And this ratio is slightly higher in our study when compared to other standard literature. Most cases of perforation seen in case of males which is probably due to their irregular food habits, alcoholism and smoking.

In our study most of the cases of perforation were seen in the age group of 31-40yrs followed by 20 – 30 yrs. The mean age of presentation is 35.26 yrs of age.

Most of the patients have previous history of peptic ulcer disease. There in is no exposure of drugs like steroids and NSAID's in long term as confirmed by history from the patient.

Regarding the presentation of patient to hospital, majority of patient reaches the hospital 2-3 days of symptoms which roughly 50% of cases. Only 11% of patients with perforation peritonitis present to us within 1 day of symptom. The mean duration of presentation is about 2.6

days. The delay in presentation of patient to may be due to ignorance and lack of convenience to the hospital care

From our study, it has been noticed that the most common site of perforation is in 2nd part of duodenum 52% followed by gastric in 42% of cases. Most are likely of peptic ulcer in origin. Only about 3 cases i.e 6% cases were due to ileal perforation and are of non typhoid in origin.

In this study, peritoneal fluid culture sent for aerobic microbial culture shows monomicrobial growth in 84% cases, polymicrobial in 2% cases and no growth in 14% cases. Gram negative enteric bacilli were being common in the culture and this includes E coli and Klebsiella followed by proteus and pseudomonas.

The most common organism grown were Klebsiella 46% followed by E coli in 34% of cases only 2% showed mixed growth of both E coli and Klebsiella. In about 7 cases i.e 14% showed no growth in their culture.

Most of the culture negative cases, presented to us within one day of symptoms of perforation and this shows that initial peritonitis was due to chemical peritonitis.

In our study, the sensitivity patterns of cultured organisms were analysed. It showed that organisms were sensitive in most cases to ceftriaxone followed by ciprofloxacin and amikacin.

But these organisms showed high resistance to ampicillin and cotrimoxazole.

E coli cultured in peritonitis in our study showed sensitivity to ceftriaxone of about 87.5% followed by ciprofloxacin and amikacin of about 81.25%.

In case of Klebsiella, the sensitivity to ceftriaxone is 91.07%, followed by amikacin which is about 78% and ciprofloxacin 73.9%.

Both E coli and Klebsiella showed high resistance to ampicilin and cotrimoxazole. We have noticed mild increase in resistance to ciprofloxacin and amikacin group of drugs.

Metronidazole in the treatment of anaerobic bacterial infection still holds good. Development of resistance to metronidazole among anaerobes is still very low and is confirmed in many studies.

But development of resistance to aerobic bacteria is on the rise, due to inadvertent use of antibiotics. Due to this fact there has been confusion in selecting the empirical antibiotic therapy.

From this study, it concludes that drug that is most sensitive in most of cases of perforation peritonitis is cephalosporins followed by quinolones and amikacin group of drugs.

Most of the cases showed resistance to ampicillin and cotrimoxazole group drugs.

CONCLUSION

In this study, it is concluded that perforation most commonly seen in duodenum followed by stomach. Most of the cases were due to peptic ulcer disease.

Secondary peritonitis caused in these cases was most commonly due to Klebsiella followed by Escherichia coli and rarely by mixed, proteus and pseudomonas.

Both Klebsiella and Escherichia coli were sensitive to cephalosporin group of drugs followed by quinolones and then macrolide antibiotics.

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PROFORMA

Name :

Age :

Sex :

Ip no :

Chief complaints :

Complaints and duration of symptoms

Detailed history:

Past history: H/O DM/HT/IHD/tuberculosis/ fever/asthma

Previous treatment history for peptic ulcer disease:

Clinical examination:

general and systemic examination

investigation :

basic blood investigation and ECG

x ray chest and abdomen

site of perforation- duodenal/gastric/ileal/others

peritoneal fluid culture –

organism grown

sensitivity pattern for organism grown

CONSENT FORM

Name :

Age :

Sex :

எனக்கு வயிற்றில் உள்ள குடலில் ஓட்டை எற்பட்டு இருப்பதை மருத்துவர் கூற அறிவேன். அதற்க்கு அறுவைசிகிச்சை செய்ய வேண்டும் என்பதையும் மருத்துவர் கூற அறிவேன். மேலும் எனக்கு அறுவைசிகிச்சை செய்து கொள்ளவும், அறுவைசிகிச்சையின் போது வயிற்றில் உள்ள நீரிணை பரிசோதைனைக்கு எடுத்து கொள்ள சம்மதம்.

Signature and name of the Volunteer Signature and Name of witness

Signature of the investigator:

DATE:

PLACE: COIMBATORE

KEY WORDS

Peritonitis, peritoneal fluid culture, antibiotic sensitivity

MASTER CHART

Sl.No	Name	Age/Sex	IP.No	Duration of Symptoms	Site of Perforation	Organism Grown	Antibiotic Sensitivity				
							Ampicillin	Ciprofloxacin	Ceftriaxone	CTZ	Amikacin
1	Rajkumar	41/m	43928	3	Gastric	E.Coli	R	S	S	R	S
2	Rajendran	52/m	43112	3	Duodenum	E.coli	R	S	S	R	R
3	Duraisamy	45/m	49912	2	Gastric	klebsiella	S	S	S	R	S
4	Murugan	52/m	49422	2	Duodenum	klebsiella	R	S	S	R	S
5	Arunkumar	31/m	49468	5	Gastric	Klebsiella	R	R	S	R	S
6	Perumal	51/m	49600	2	Ileal	klebsiella	R	S	S	S	S
7	Divakar	24/m	582013	3	Duodenum	E.coli	S	S	S	R	S
8	Shanmugam	22/m	62613	>5	Gastric	klebsiella	R	S	S	R	S
9	Raj	20/m	64784	2	Duodenum	klebsiella	R	S	S	R	S
10	Avinasiyappan	51/m	67650	4	Duodenum	E.coli	R	S	S	R	S
11	Arunachalam	41/m	70549	4	Gastric	E.coli	R	S	S	R	R
12	Sankarapandiyan	48/m	70550	3	Duodenum	E.coli	R	S	R	R	S
13	Rajkumar	38/m	72782	2	Gastric	klebsiella	R	R	S	R	S
14	Annapoorani	32/f	76993	4	Duodenum	Klebsiella	R	S	S	R	R
15	Arputharaj	332/m	75951	2	Duodenum	klebsiella	R	S	S	R	S
16	Shaoy	39/f	79107	5	Gastric	E.coli	R	R	S	R	S
17	Senthil	32/m	75951	5	Gastric	klebsiella	R	S	S	R	R
18	Thangavelu	38/m	77542	2	Gastric	klebsiella	R	R	S	R	S
19	Ajantha	51/m	76680	4	Duodenum	E.coli	R	S	S	R	S
20	Sathish	22/m	77956	4	Duodenum	E.coli	R	S	S	R	R
21	Sasikumar	24/m	79213	1	Duodenum	No growth	-	-	-	-	-
22	Jayaprakash	21/m	78300	4	Duodenum	klebsiella	R	S	S	R	S
23	Periyasamy	38/m	83275	>5	Gastric	klebsiella	R	S	R	R	S
24	Kumar	31/m	959	2	Duodenum	klebsiella	R	S	S	R	S
25	Banjithbai	22/m	1155	3	Ileal	E.coli+kle	R	S	S	R	S

MASTER CHART

26	Palanisamy	37/m	1175	>5	Duodenum	E.coli+kle	R	S	S	R	S
27	Sivaraj	21/m	1524	1	Gastric	No growth	-	-	-	-	-
28	Selvan	48/m	1608	3	Duodenum	E.coli	R	S	S	R	S
29	Ramar	28/m	3925	4	Gastric	klebsiella	R	R	S	S	S
30	Murugesan	45/m	3898	4	Gastric	klebsiella	R	S	S	R	R
31	Shanmugam	45/m	7312	5	Duodenum	E.coli	R	S	S	R	S
32	Malarmannan	51/m	7016	2	duodenum	E.coli	R	R	S	R	S
33	Murugesan	35/m	9405	3	Ileal	pseudomonas	R	S	S	S	S
34	Pandiyan	21/m	10727	5	Gastric	klebsiella	R	S	R	R	S
35	Gayathri	28/f	11349	3	Duodenum	klebsiella	R	R	S	R	S
36	Rajan	32/m	14172	2	Gastric	E.coli	S	S	S	R	S
37	Rajeshwari	42/f	18016	4	Duodenum	E.coli	R	S	S	S	S
38	Suresh	34/m	23873	1	Gastric	No growth	-	-	-	-	-
39	Chandra	35/f	26881	4	Duodenum	klebsiella	R	R	S	R	S
40	Chinnan	51/m	28462	2	Duodenum	E.coli	R	R	S	R	S
41	Mahendran	45/m	28222	4	Gastric	klebsiella	R	S	S	R	R
42	Kabil	41/m	30311	3	Duodenum	klebsiella	R	S	S	R	S
43	Stephen	31/m	31033	4	Duodenum	proteus	R	S	S	R	R
44	Kannan	35/m	31094	5	Gastric	E.coli	R	S	R	R	S
45	Aruchamy	51/m	31862	2	Gastric	klebsiella	R	S	S	R	S
46	Madhammal	31/f	40904	>5	Duodenum	klebseilla	R	S	S	R	R
47	Paramasivam	52/m	49182	2	Duodenum	No growth	-	-	-	-	-
48	Karthik	32/m	45835	2	Gastric	No growth	-	-	-	-	-
49	Praveen	26/m	25495	1	Gastric	No growth	-	-	-	-	-
50	Nesa kumar	21/m	79149	1	Duodenum	No growth	-	-	-	-	-